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MEMBER A.B.C.

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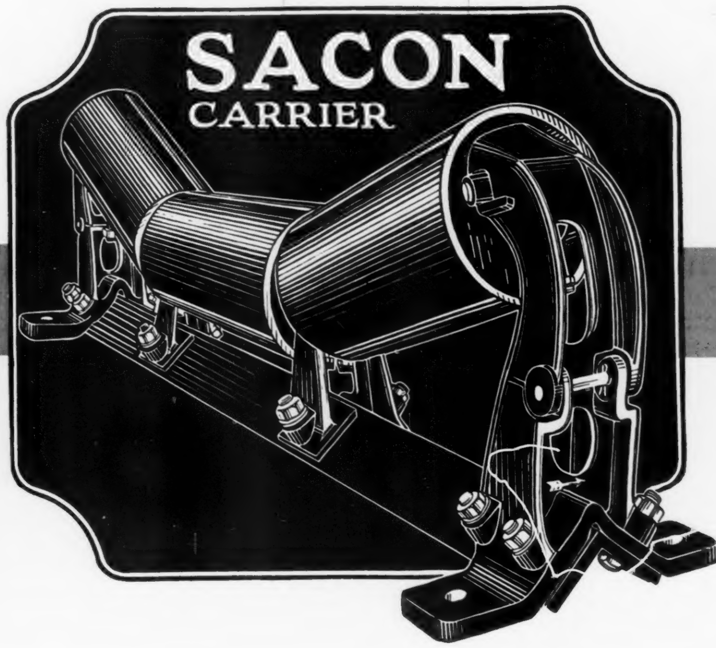
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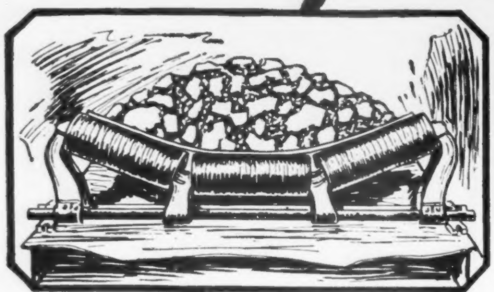

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Vol. XXVIII | Chicago, November 14, 1925 | Number 23

The Largest Sand and Gravel Operation in the Pacific Northwest

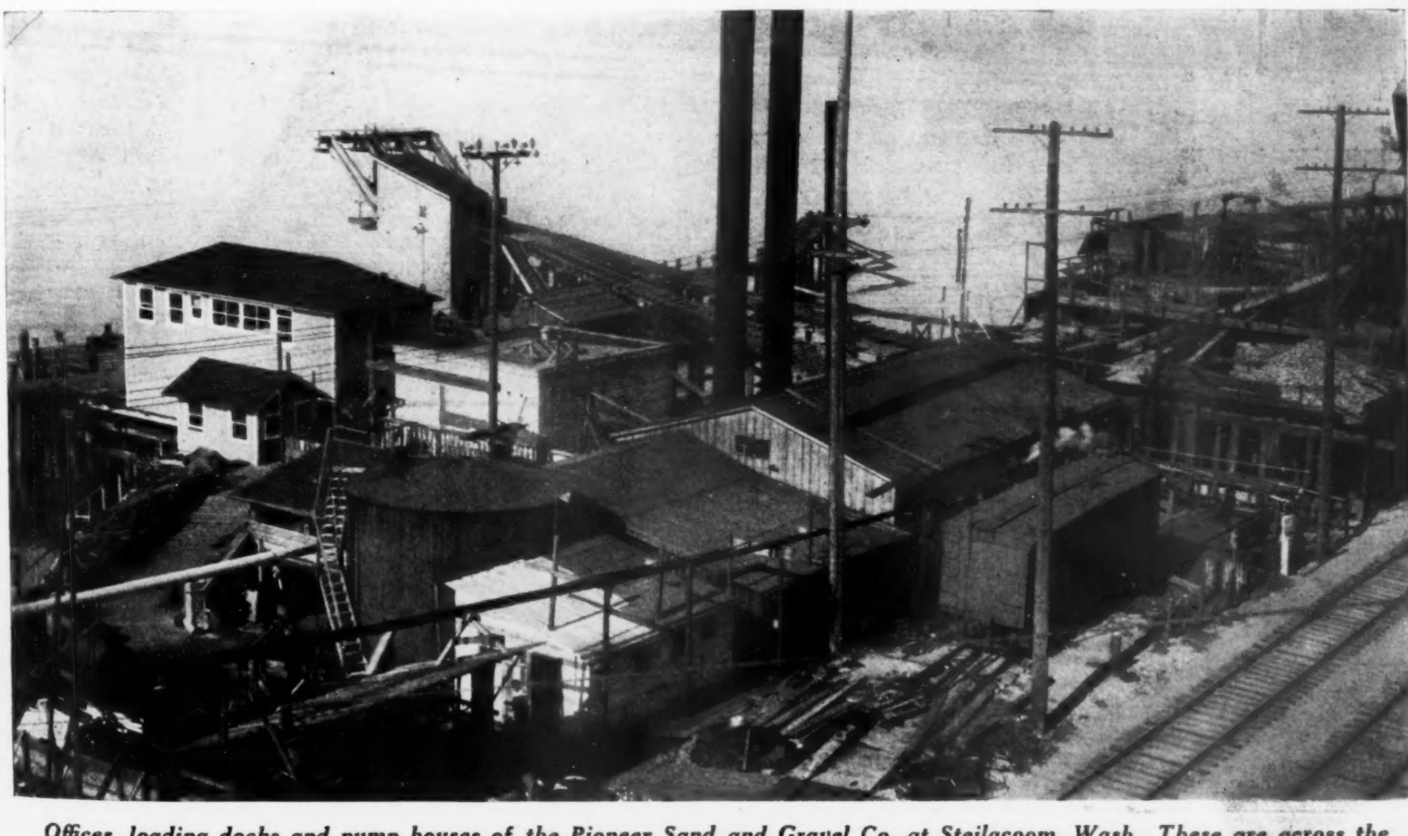
Pioneer Sand and Gravel Company of Seattle, Washington, Employs Unusual Methods of Excavating the Bank Material and Has a Unique Washing and Screening System

THE Pioneer Sand and Gravel Co. of Seattle, Wash., is easily the largest producing company in the state. Its principal plant is at Steilacoom, which is about 13 miles south of Tacoma, but it operates other small plants as well. The Steilacoom plant alone produces 100,000 yd. per month.

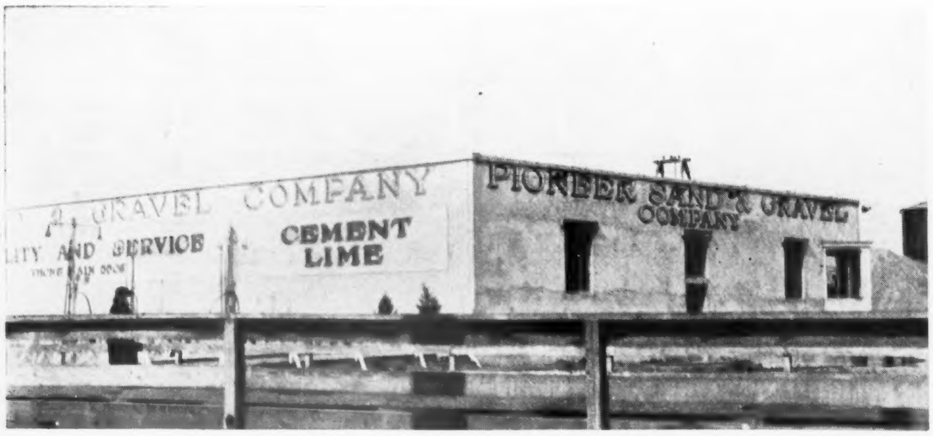
The company has five "bunkers," as the delivery yards are always called on the Pacific coast, and supplies two retailers. All the sand and gravel is brought in by barges, but the waterfront of Seattle is so extensive and connects with so many canals and passages that every part of the city is near a water-way. Hence all the bunkers are situated so that delivery to any part of the section which it serves means only a short run with a truck.

The largest of these delivery yards is on Spokane avenue, Seattle, in which the company not only has storage piles and loading bins but also a mixed concrete plant. At this yard Blaw-Knox circular bins are used for loading trucks; at the other yards the bins are all of the usual square type built of timber.

At all these yards, except that on Spokane



Offices, loading docks and pump houses of the Pioneer Sand and Gravel Co. at Steilacoom, Wash. These are across the railroad track from the deposit



Office and warehouse at Spokane avenue yard, Seattle

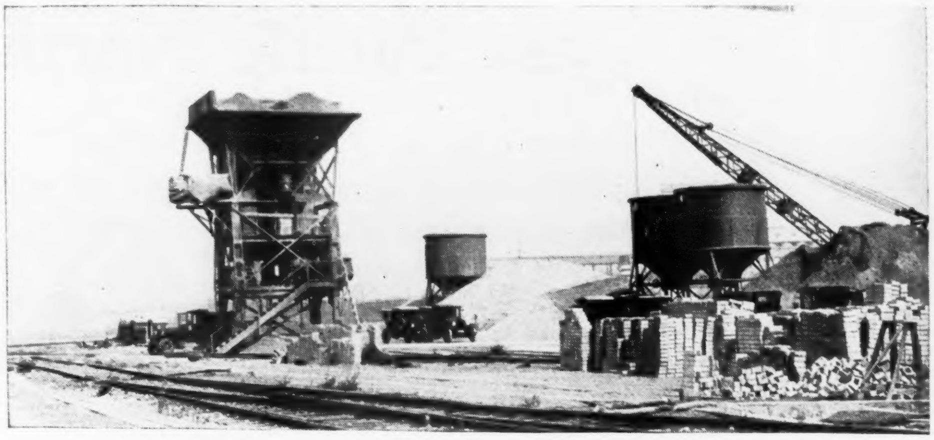
avenue and one other, the gravel is received in barges, which are unloaded by a stiffleg derrick with a clamshell bucket. Various types of derricks are used, but Blaw-Knox clamshells of 1½-yd. to 2½-yd., are used throughout. Such a rig has a capacity of 60 to 100 yd. per hour, and at most of the yards 1000 yd. are carried in storage in the bunkers. The company employs a large fleet of trucks for the delivery of sand and gravel and also for delivering the other building materials, cement, lime and plaster, which it handles. From 35 to 40 trucks are kept constantly employed in this service.

A second exception to the regular method of unloading barges was noted. At the yard where this is used special barges are delivered. These have passageways under the deck in which are rails on which cars run. These are filled through gates in the deck above and then drawn out. The method is more completely described on the Hints and Helps pages of this issue.

The Deposit

The Steilacoom plant, from which by far the greater part of the production is obtained, is remarkable for the unusual methods which are used in excavating the bank material and in washing and screening it. The deposit itself is unusual since it contains sand and gravel in just about the right proportions to supply the demands of the market. At present a little ⅝-in. gravel has to be wasted, but arrangements are being made by which this can be worked into a marketable product.

The deposit is marked "delta gravel" on the maps of the United States Geological Survey. This means that it has been carried to its present situation by a river which dropped it as the current slowed down before the river debouched into the ocean. But the source of the gravel was the moraines of the Nisqually glacier which had its source on Mount Rainier. Hills of glacial material (drumlins) may be seen between the plant and Tacoma, most of which appear to be quite unfit to work for sand and gravel since they contain so much clay. Where such hills have been eroded and the clay washed out so that only the clean sand and gravel remain, we have the finest type of gravel deposit for working.



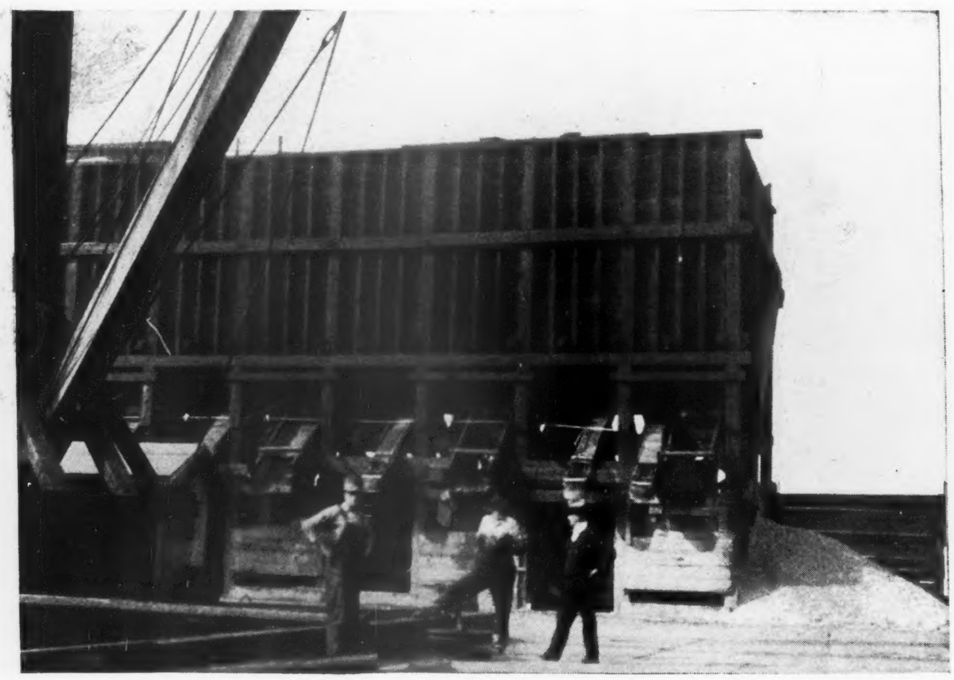
Mixed concrete plant and truck-loading bins at Spokane avenue yard

Gravel of Excellent Quality

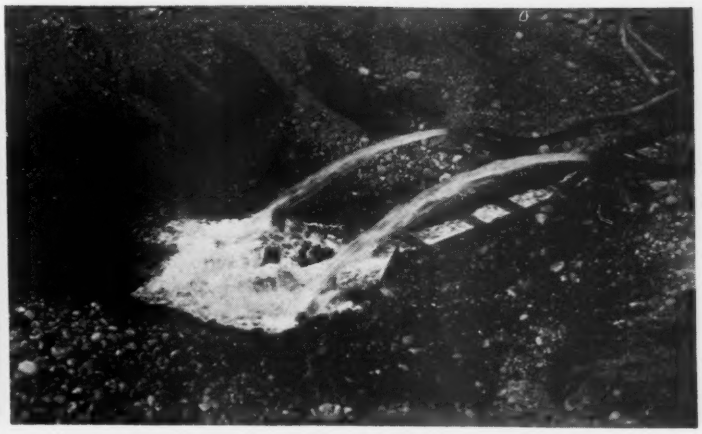
The gravel is of hard stones, both of sedimentary and igneous origin, and is quite free from shale and other objectionable material and also from organic matter. An engineer, who has made a survey of the aggregate resources of the Pacific coast and southwestern states, says that with perhaps one exception this is the finest gravel for concrete purposes that he has discovered. The abundance and quality of such a material near at hand has undoubtedly had much to do with the popularity of concrete as a building material in Seattle, Tacoma, and other northwestern cities.

The face of the deposit as it is worked at present is 160 ft. high, but the present workings are going below grade and are still in excellent material so this figure by no means represents the total depth of the deposit, which rises 240 ft. above tidewater.

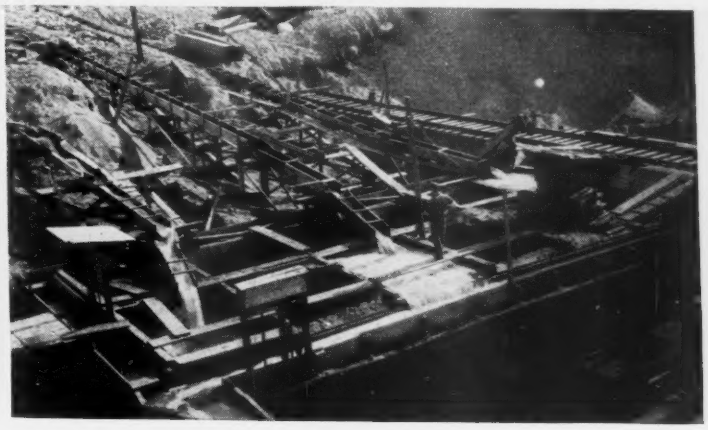
On account of the great height of the face, special means have to be taken to prevent it from caving, especially where the ground is worked by the steam shovel. The method employed is that of running a stream of water over the face which cuts away the top of the bank and causes a lot of the sand and gravel to pile up at the bottom. The method is exactly the same as that by which



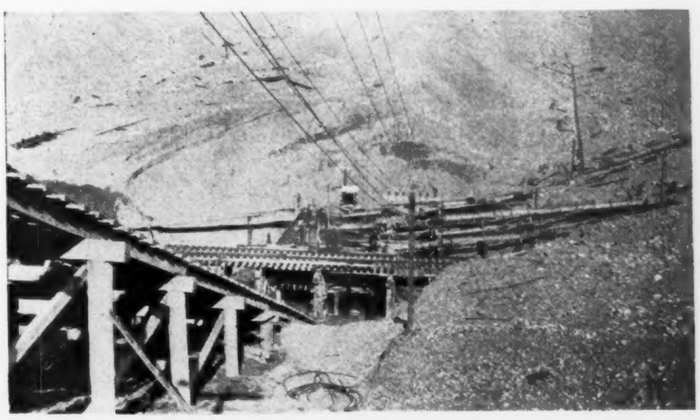
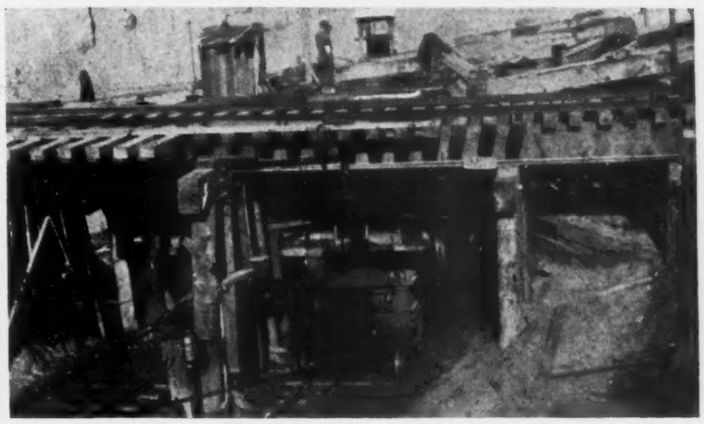
Type of truck-loading "bunker" in use at delivery yards. It is loaded from barges by a derrick

Left—Ground being sluiced. Note the grade needed for hydraulicking. Right—The two streams playing on the foot of the bank and washing the gravel into the sluice

Left—The sluices leading from the bank to the dewatering bins. Right—The dewatering bins

Left—the cars take bank material from dewatering bins up the incline to the plant. Right—Car being loaded


Left—Incline up which the material is hoisted to the plant. Right—Sluicing from storage pile to washing plant

a bank is naturally eroded by streams of rain water and the debris piled up at the bottom. The surprising thing about the method is the large amount of material that can be moved with a comparatively small amount of water. No force need be given the stream, as all that the water has to do is to soften the bank so that it may slide.

The greater part of the production is dug by a 65-ton Thew steam shovel. This is of the revolving type and is mounted on car wheels. It digs about 240 yd. per hour. Sluicing is also used at this plant. The sluiced material is run down to a pit and then raised up an incline. A McMyler Interstate crane is used in one part of the deposit for digging pit run that is used for railroad ballast, and when it is not used in this way the crane is used for building stockpiles.

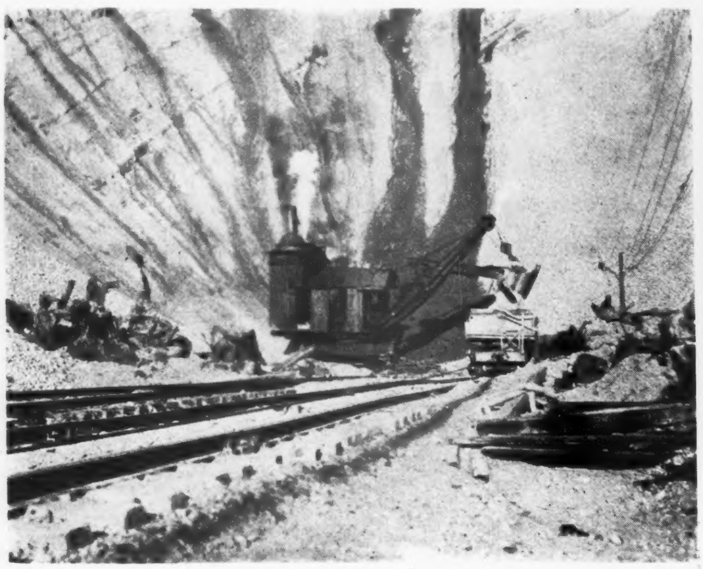
Method of Hydraulicking

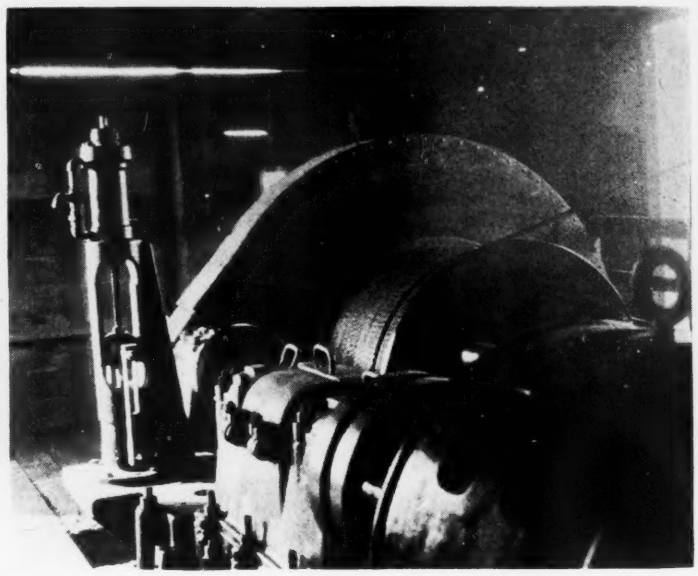
Formerly all the working in this deposit was by sluicing, or "hydraulicking," as it is usually called throughout the west. In looking at the old workings it is easy to see one of the reasons why this method is being abandoned. The sluices through which the hydraulicked material and the water flow to the plant are given a 12½% grade to keep them from choking with the larger stones.

Type of car used in hoisting

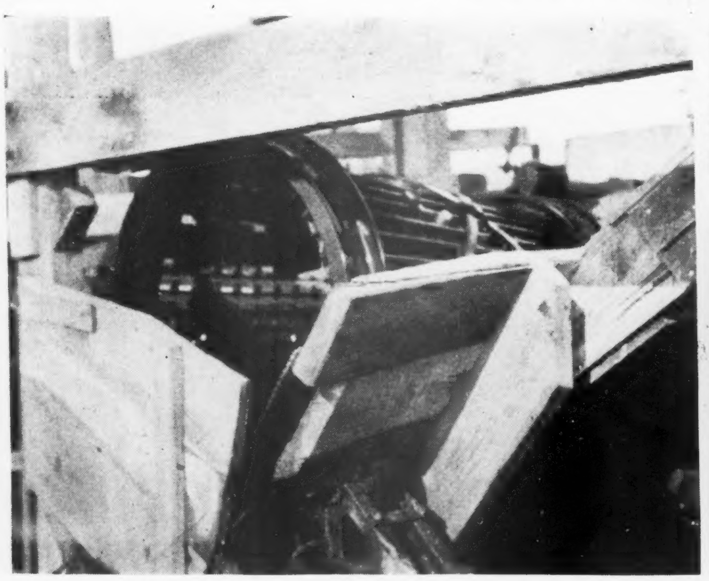
This becomes the grade of the working, and as the work proceeds into the bank the depth of the deposit that can be recovered decreases until more gravel is left behind than is sent to the plant. The long flat grades left from the hydraulic operations contain a large amount of excellent material which will some day be recovered by a steam shovel.

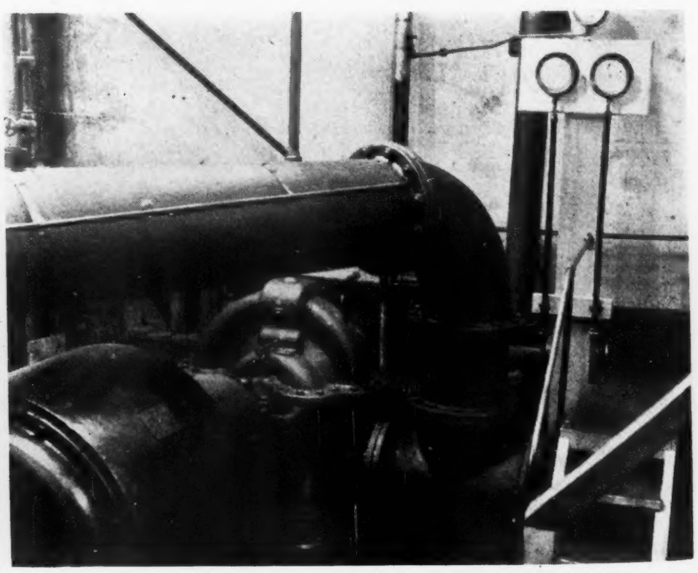
There is a fascination about the simplicity and the apparent ease of hydraulicking that tempts one to use it wherever there is a grade. But taking everything into consideration, where the water has to be pumped, the method is expensive, and it is doubtful if it can be so well employed in any regular producing operation as more conservative methods. Of course where abundant water under pressure may be had for the cost of piping, and especially where the material does not have to be drained and loaded on to cars, the conditions favor sluicing above other methods, and this was the case in the California placer mines where hydraulicking was developed.





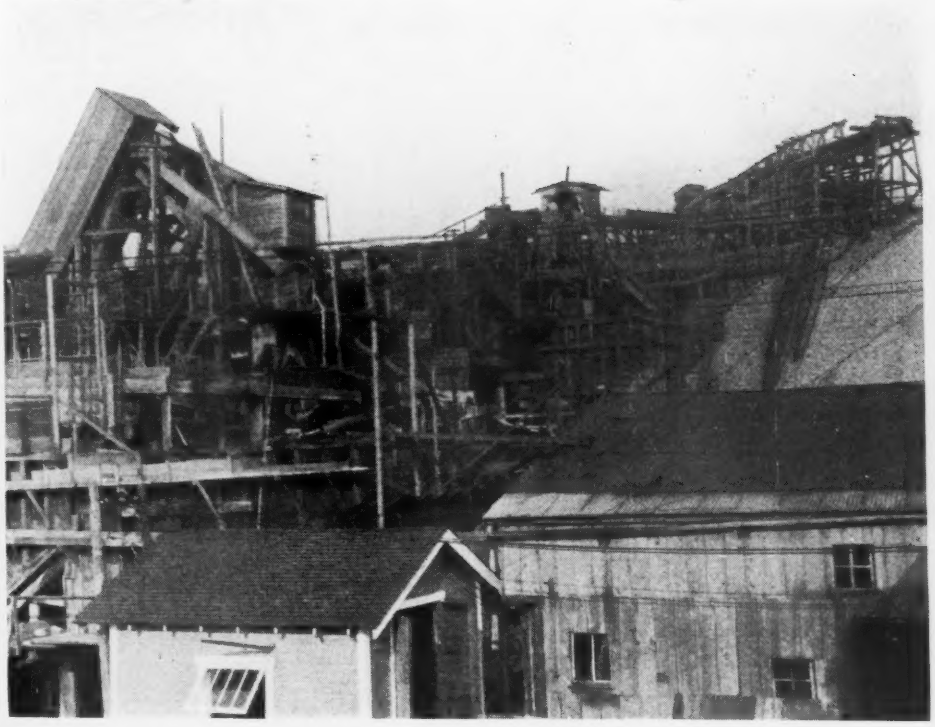
Left—Steam shovel loading cars. The bank is almost 200 ft. high and has to be sluiced back to protect the shovel. Right—One of the automatic electric hoists



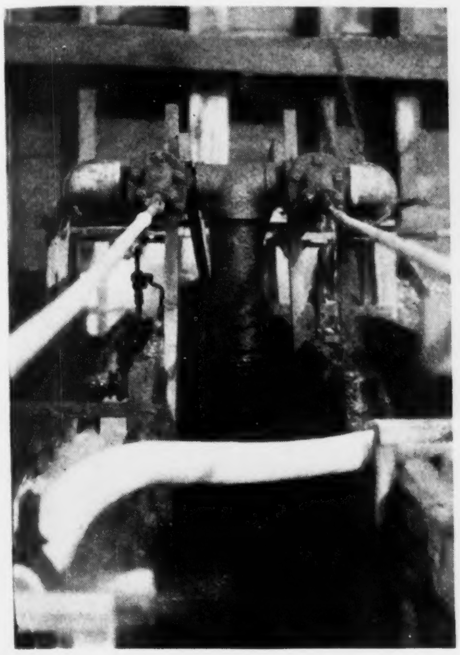


Left—One of the revolving grizzlies. Right—One of the two 14-in. volute pumps which are used in series to give pressure

The sluicing operations take a great deal of water and this must be delivered with considerable pressure. The main pumping unit consists of two 14-in. Cameron double volute pumps, the discharge of one being turned into the suction of the other which acts as a booster. Each pump is direct-connected to a 300-h.p. General Electric motor. The water furnished by this arrangement is 5600 g.p.m. An auxiliary pumping unit was just being installed when the plant was visited in September. This consists of an 8-in.



View of part of the washing plant as seen from the office building



The arrangement for sluicing from a bin to the washing plant

De Laval centrifugal pump direct-connected to a 150-h.p. General Electric motor and this furnishes 2700 g.p.m., which is used in the washing operations.

Hydraulicking this deposit is complicated by the fact that much of the gravel lies in distinct strata with no sand to fill the interstitial spaces. When the water strikes a gravel stratum of this kind it simply disappears, as it is drained away through the gravel without doing any cutting. This has been overcome by forcing short sections of a sluice box into the gravel and playing the water on the material in the box to wash it down with occasional "shots" at the gravel on the side to keep it falling into the box. In this way the loss of much water is avoided. In sluicing gravel which contains sand, so that the water is not drained away as soon as it strikes the bank, the streams are shot ahead of the box in the usual way. Fire hose, 2½ in. in diameter is used to carry the sluicing water.

All the water used is salt water from the bay. The water used in hydraulicking brings the sand and gravel down to a series of bins into which the solids settle while the water overflows into a waste launder. From these bins the sand and gravel are hoisted in 4-yd. cars to the head of the washing plant. There are two hoists for pulling the cars up the

The water coming through the deflector screen strikes these baffles

incline and these are interesting from the fact that they are of the automatic or remote-control type. They were made by the Wellman-Seaver-Morgan Co. of Cleveland, Ohio, and have 135-h.p. motors.

At both points to which the bank material is delivered by sluicing there are 12 bins

One of the loading docks with movable spout

used for dewatering and a car track runs under all of them. The car is spotted under the bin which it is designed to empty by pulling out a switch which stops the hoist. When the car is loaded from a gate in the bottom of the bin the switch is thrown in and the car moves up the incline. It is fascinating to stand in the hoist house and watch the switches snap in as the speed builds up just as though an operator was standing at the levers. A switch cuts in resistance as the car reaches the top and thus slows down the car for dumping. After the car has been dumped the hoist is automatically reversed and lowers the car back to be filled. The cars were specially made for this work by the Pacific Car and Foundry Co.

There are two of these hoists in operation as there are two sets of dewatering bins. The material from the steam shovel is hoisted by a double-drum hoist of the usual type made by the Washington Iron Works of Seattle. The making of these large hoists is quite an industry in Seattle since they are much used in mining and lumbering.

The hoisted material is sluiced to the washing plant by streams of water. The illustrations show one case in which the sand and gravel are brought out from a bin by two streams of water directed into the gate. This is an excellent method of feeding and capable of closer regulation than one might think, who has not tried it. Varying either the force of the water or the position of the sluicing nozzles affects the amount of material washed from the bin. The material falls into a sluiceway and the same water carries it down to the washing plant. The washing plant consists of several lines of screens and sand settlers and each line has a capacity of 50 yd. per hour. They vary somewhat in details, but the main features of each line are alike so that only one will be described.

The Screen System

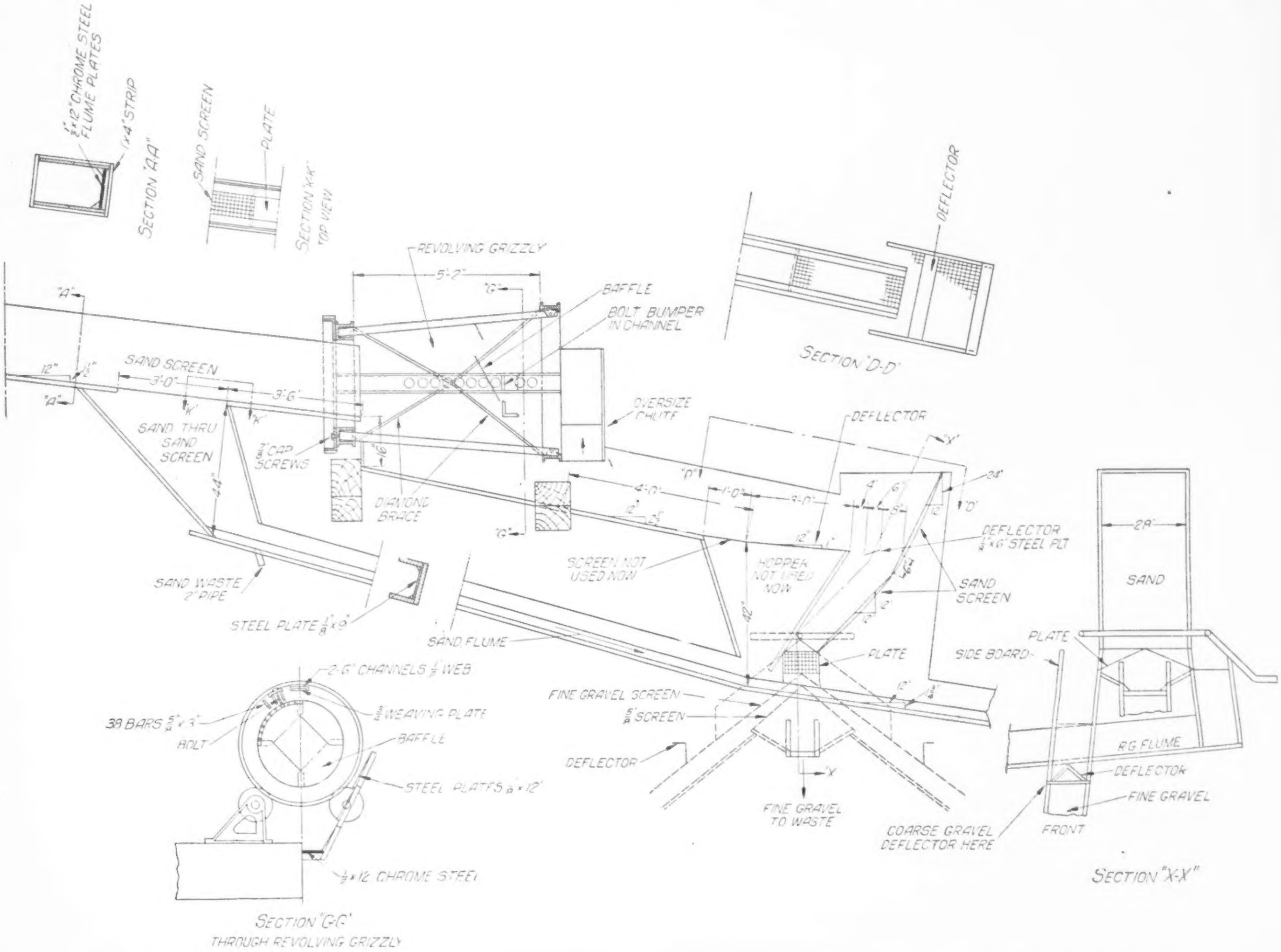
The system of screens is really unique, employing principles which, to the writer's knowledge, gained through visiting plants in every section of the country, are not employed elsewhere. Yet it is thoroughly successful, the product meeting the most rigid specifications, and while it is an outgrowth of conditions which came from hydraulicking directly to the plant, it is so satisfactory that the superintendent, Paul Jarvis, says that he would not hesitate to duplicate it in a new plant.

The underlying purpose of the system was to use as little headroom as possible. Owing to the necessity for keeping the sluices on a 12½% grade a loss of 1 in. in height meant that approximately 1000 yd. of material had to be left behind in sluicing. Consequently each inch in height that could be saved had a real value that could be figured in dollars.

The saving in headroom was brought about by using a flat gravity screen for the first separation, a revolving grizzly for the second and a deflector before the final set of screens which actually raises the material above the grade line of the launderers. This last is the unique feature, since it utilizes the momentum of the flowing material to raise itself and distribute itself over the screen, a principle not used elsewhere.

The drawing accompanying this shows a section through one of the screening systems. The sand, gravel and water flow from the bin or stockpile down a sluice that is 12 in. wide. In the bottom of this sluice is a fine screen, 3 ft. long, of a mesh such that only sand can pass. This takes out a great deal of the sand and much of the water, but it leaves plenty of the water with the oversize for further screening operations. The sand flows on down to another sand settler not shown, where it is split in two sizes, the finer sand going out with the overflow to be settled and sold for plastering sand. The coarse sand is concrete sand.

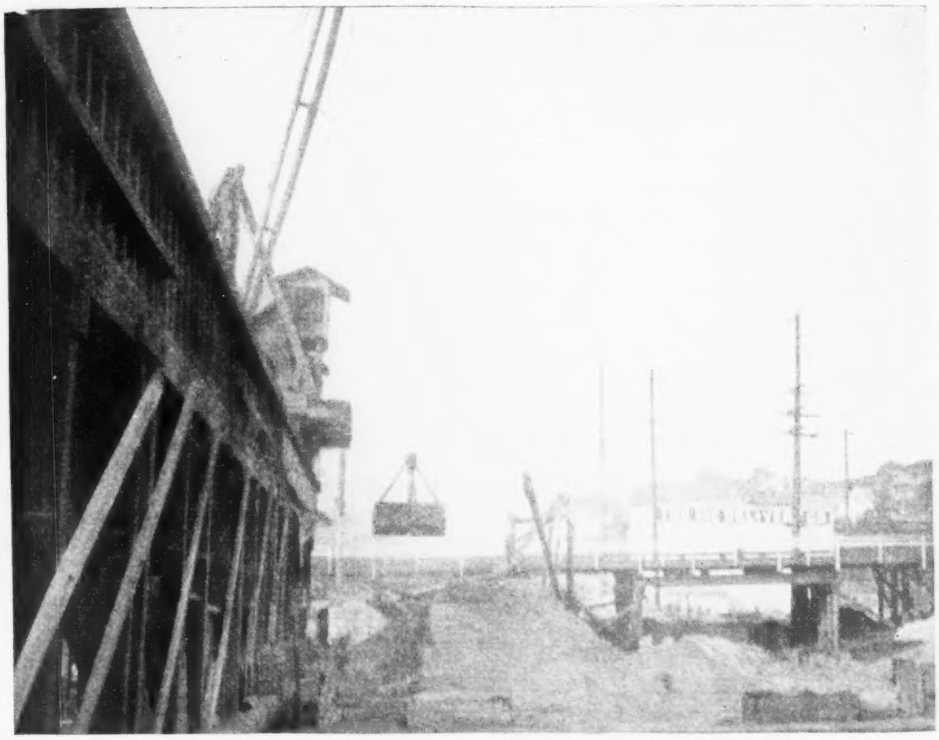
The oversize of this flat sand screen contains boulders, gravel and some sand and



A section (with details) through the unique washing and screening plant which shows how the headroom is conserved

this passes to a conical revolving grizzly. This is really a conical screen made of bars and spacers having 2-in. openings. Its great advantage is that it requires very little headroom, although, aside from this, it is an excellent separator that gives no trouble from clogging. There are five of these in use at this operation.

The oversize of these grizzlies is sent to two crushers, a Traylor and an Austin. The crusher discharge is returned to the flume below the grizzly.



Derrick on top of "bunker" unloading from barges

The undersize goes down a sluice and formerly passed over another sand screen like the first mentioned. Of late the use of this screen and the hopper below it, which shows in the drawing, has been cut out. The next screen in the series removes the sand sufficiently and the water that would go out with the sand is needed for the further screening.

The stream next strikes the deflector, a simple wedge placed in the bottom of the sluice, with the thin edge against the screen. The writer has often seen this device used to lift the stream from the bottom of a sluice or launder so that a sample could be cut across the stream but has never before seen it used to actually elevate the material above grade. After passing the deflector the material jumps out at an angle approximating 30 deg. against what is called the deflector screen.

This screen (which is to take out sand) is more nearly vertical than flat, as it is set at 65 deg. from the horizontal. The flow strikes it and a part of the sand and the water goes through. The rest flows down on a second sand screen set at 45 deg so that gravity does the work. This takes out the remainder of the sand and the water. The gravel falls on the "hip," two plates arranged like a rather flat roof which splits it two ways. Each way leads to a set of simple gravity screens which make three products, roofing gravel, a part of which is at present sent to waste; fine gravel, and coarse gravel. The coarse gravel goes directly to bins and the fine gravel is sluiced to bins on either side of the coarse gravel bins.

The product may be varied widely and different mixtures of sizes may be made by changing the screen sections or by varying the angle of their inclination. So it answers every requirement of the conditions under which it is used and it is one of the neatest devices for screening with little loss of headroom that has been noted. On the other hand it might be questioned whether or not it would be as satisfactory as a more conservative screening arrangement under some other conditions.

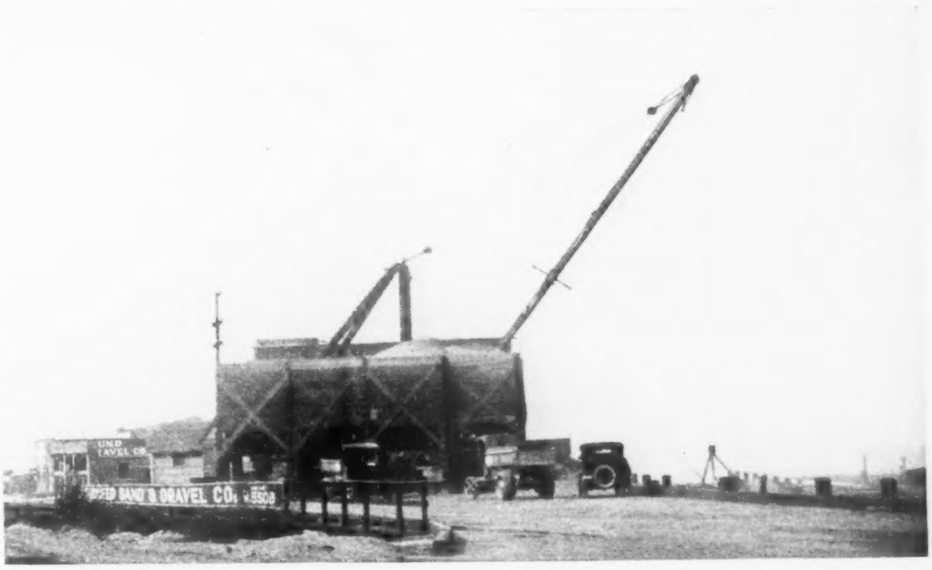
The sand and gravel are loaded on barges and also on railway cars. The greater part of the product is loaded on barges, for the coast line of Puget Sound is so indented with bays and river mouths that almost any place of importance may be reached by barge transportation. In places near the two principal cities, Seattle and Tacoma, the government has cut canals from one waterway to another which aids greatly in the distribution of products by water.

The company operates other plants and one of these, at Ranier beach, is a washing plant of the usual type employing Stephens-Adamson (Gilbert) screens and Link-Belt sand tanks. The material washed is produced by a dredging operation undertaken to deepen the channel of Cedar river, which is 10 miles away. From the operation of this plant the company has ample data for comparing one system with another. It also operated a plant called Central Pit, where plaster sand is produced.

Future plans of the company include a greater use of the shovel and a Marion 125-ton shovel, electrically powered, is to be installed. A new washing and screening plant will be built as soon as the present operations have cleared the ground where the plant is to stand.

A considerable amount of railroad gravel ballast is produced at the Steilacoom plant and this is washed in a slightly different manner than that described, but the system of screens is much the same.

The Pioneer Sand and Gravel Co. has its main office in the Leary building, Seattle. H. F. Ostrander, who is president of the company, is connected with a number of important West Coast interests. D. L. Williams, vice-president and manager of the company, has been in the sand and gravel business in and near Seattle for a good many years. Paul Jarvis is superintendent of the Steilacoom plant and also of the plant at Central Pit.



The delivery yard, almost in the heart of Seattle, receives barges by water

Possibilities for the Commercial Use of Anhydrous Gypsum

A Translation of the Most Recent Work by European Investigators and the Report of the U. S. Bureau of Mines

By I. Bencowitz

WHEN gypsum is heated to about 120 deg. C. it loses the equivalent of 1½ molecules of water and forms the hemi-hydrate $CaSo_4$, $\frac{1}{2}H_2O$, as a white powder called plaster of paris, which is a mixture of the anhydrous, dihydrate and hemi-hydrate.

The transition temperature at which gypsum, $CaSO_4$-$2H_2O$ passes sharply into the hemi-hydrate is 107 deg. C. If gypsum is heated with water under pressure at 150 deg. "silky" needle-like crystals of the hemi-hydrate are formed. When gypsum is burned at a temperature of 900-1000 deg. C. the product is known as hydraulic gypsum. This product consists of a mixture of insoluble anhydrite and calcium sulfate or free lime.

Plaster of paris in setting is supposed to form a mass of interlacing needle crystals of dihydrate ($CaSo_4$, $2H_2O$).

Anhydrous calcium sulfate is more soluble than plaster of paris, and, accordingly, when water is mixed with the plaster, the anhydrite ($CaSO_4$) dissolves first, and passes into the dihydrate. This recrystallizes about the undissolved particles of the dihydrate in needle-like crystals.

If plaster of paris be heated above 200 deg. it passes into anhydrous calcium sulfate, which when mixed with water does not set because it takes up water very slowly. This is the so-called "dead burnt" plaster. A. Potylitzin called this Beta-$CaSO_4$ to distinguish it from the Alpha-$CaSO_4$, formed between 120-200 deg. C., which readily takes up water and hardens. According to Rockland, another soluble form, similar to, if not the same as Alpha-$CaSO_4$, is formed when gypsum is heated to about 520 deg. This is the "Estrich Gyps" or "flooring plaster" of the Germans, so named because it is largely used in Germany for making floors.

The slower rate of setting of hard-fired plasters is probably due to (1) delayed recrystallization of the dihydrate owing to super saturation, and (2) to the slower rate of solution of the anhydrite calcined at a high temperature.

The phenomenon of "setting" of plaster of paris can be ascribed to the crystallization of the dihydrate from the saturated solution due to the fact that the dihydrate is less soluble than the calcined form. The crystals interlock with each other, giving strength to the mass. Recently, many investigators[2] have explained the "setting of gypsum" as a colloidal process.

According to this view, calcined gypsum, when mixed with water, forms a colloidal gel from which it crystallizes in needle-like crystals. The phenomenon of "setting" of hydraulic gypsum, however, is fundamentally different from the "setting" of plaster of paris.

IN these two articles are set forth the most advanced experimental work of European and American investigators on the hydration of anhydrite ($CaSO_4$). The anhydrite as a natural mineral or chemical by-product has little commercial use, but the hydrated form ($CaSO_4$ $2H_2O$) has many important uses.

The European scientists have devoted their efforts to accelerating the hydrating of anhydrite by means of catalysts and have obtained excellent results, particularly from sodium acid sulphate.

The American investigators found that hydration could not be obtained by pressure up to 19 atmospheres. The successful method was by fine grinding of the anhydrite in a colloid mill or pebble mill, wet or dry. Complete hydration of the coarsest samples took place in 18 weeks and with the finest sample in three weeks. The gypsum so made was excellent for plaster of paris or portland cement retarder. This process appears to have commercial possibilities.

The researches of Glasenapp[3] and Budnikov and Sirkin[4] not only explained the nature of hydraulic gypsum but also proved that in the process of "setting" of the insoluble anhydrite, calcium oxide (CaO) plays the chief part. These researches suggested the possibility of activating natural anhydrite or anhydrite obtained by burning ordinary gypsum at a temperature of 600-700 deg. C., by grinding it together with calcium oxide to a fine powder. It is well known that until recently all attempts to activate "dead" modifications of calcium sulfate did not give practical results[5].

The first practical suggestion to employ lime for htis purpose was made by Hortner.[6] It was he, also, who showed that the anhydrite will set without the addition of any foreign matter. He showed that when the anhydrite is ground to a very fine powder it gains the property of "setting."[7]

The extent of the "setting" is determined exclusively by the fineness of the powder. In this connection it may be in order to mention that Emely in a note to a paper by Gil[8] pointed out that his (Gil's) investigation established the point that both the anhydrite and dead-burnt gypsum will hydrate if given sufficient time.

The most recent investigations in colloidal chemistry maintain that there is no definite line of demarcation between a mechanical suspension and a colloidal and molecular solution. In all these three conditions, we have a dispersed system, the physical and chemical characters of which are not identical, i. e., the properties change periodically, coarse → suspension → colloidal → molecular solutions.

In other words, if it should be possible to obtain a substance in such fine subdivision that it will be in a colloidal or molecular condition, then the particles will have a correspondingly higher reaction rate. That is to say, the solubility, the rate of solution and other similar properties will be much higher as the size of the particles approach molecular dimensions. The practical border-line of mechanical and colloidal sizes is 0.0001 mm.; the border-line of the sizes of the particles in colloidal and molecular solutions is

[2] Cavazzi Gazz. Chim. Ital. **42** (11), 626 (1912). Traube, Kall. Z. **25**, 62 (1912). Wo. Ostwald and Wolski, Kall. Z. **25**, 78, (1920.

*Prepared from an article by Budnikov and Levin in the Bull. Inst. Polytech. Ivanovo Vosniesensk 8 32 (1920).

[3] Tonind. Ztg. (1908), 1148; (1912) 401, (1919) 749. Studien uderStuckgips, Totgebranten and Estrichgips, Rigo, 1909.

[4] Chem. Ztg. **47**, 22 (1923).

[5] Vant-Hoff Z.f. Physikal. Chim. (1903) 3, 281; Gary, Buch der Erfindingen Vii, 62, D.R.P. 74,868; 194,316. Gmelin-Kraut, Handbuch der Anorg. Chem. **7**, Aufl. 11 2 p. 234, Glasenapp, Tanid-Ztg. (1909) 749; (1912) 402, (1904) 482.

[6] D.R.P. 312,239, Z. B. (1920).

[7] Z. Angew, Chem. **33** (1920) 175.

[8] J. Am. Cer. Soc. **1**, 65-71 (1918).

0.000001 mm. If the sizes of the particles of the anyhydrite are too coarse, it will be altogether passive and will not hydrate at all.

The investigations of Budnikov and Sirkin on the activation of anhydrous, insoluble anhydrite and the natural anhydrite have shown that this activation can be brought about with the use of various substances.

Inasmuch as the "setting" of gypsum is controlled primarily by the process of hydration, the chief problem, therefore, was to find such substances which would accelerate the rate of hydration. The first experiments published in 1919 were made with calcium oxide as a catalyzer. This process of activation however, requires so much time that it may be justifiable to say that such gypsum from a practical point of view lacks the property of "setting." In the presence of the soluble modification, on the other hand, the anhydrite quickly goes into solution, super-saturates it, and precipitates out as gypsum.

The presence of alkali, acids, neutral and acid salts in very small quantities accelerate this process more or less, i.e., they help the hydration of the anhydrite.

Experimental

The material used in this investigation was natural anhydrite, which was ground in an agate mortar until it passed a sieve of 4900 openings to one sq. cm. To a definite weight (about 2 gms.) of fine powder of the anhydrite was added a weighed quantity of the finely ground catalyzer and then was thoroughly mixed in a small test tube fitted with a ground stopper. The homogeneous mass was then placed on a weighed watch glass and it was weighed again. To the mixture was then added 1.5 cc. water and the watch glass was placed first for seven days under a glass bell in which was an open porcelain dish with water, and then in an electric oven for seven days. The temperature of this oven was kept constant at 35-36°C. For substances which are easily soluble in water this procedure was somewhat modified. In the latter case, the weighed quantity of the anhydrite was covered with 7.5 cc. of water in which was dissolved the required quantity of salt. After seven days, the glass was reweighed. The difference in weight was assumed to be the water of hydration, inasmuch as at a temperature of 35-36 deg. C. the chemically bound water does not evaporate. Repeated experiments proved the correctness of this assumption. The weighed samples, after drying for a week, were placed in a drying oven for another week, after which a second reweighing showed that there was no change in weight. In order to determine the presence of the dihydrate, the dried sample was heated in an oven at 150 deg. C. and then was treated with water. A vigorous reaction followed by rapid hardening indicated the presence of the dihydrate. The results of the experiments are shown in Table I.

TABLE I

Test No.	Catalyzer	Added Catalyzer in per cent of the weight of the anhydrite at the maximum hydration	Maximum hydration in per cent
4	$NaOH$	2	2.39
51	$Na_2HPO_4, 2H_2O$	6	2.23
39	$NaHSO_4, H_2O$	1.5	13.25
16	CaO	3	2.30
91	$MgSO_4, 7H_2O$	6	1.98
65	$MgCl_2, 6H_2O$	9.3	1.42
67	$ZnCl_2, 2H_2O$	1	3.53
31	$Al_2(SO_4)_3, 18H_2O$	3	2.14
56	HCl	2	7.50
68-69	Fe_2O_3	No hydration was observed	
70-80	Fe	No hydration was observed	

It is seen from the table that the maximum hydration takes place when sodium acid sulfate was employed as a catalyser. In view of the fact that natural anhydrite contains 7.5% water and that this water has already partly formed the dehydrate, then it becomes obvious from the above figures that almost complete hydration took place.

All these substances act catalytically. However, the size of the grains has a very important significance inasmuch if a certain definite degree of subdivision has not been obtained, the anhydrite shows almost complete passivity and does not hydrate at all. When acids and acid salts are used as catalyzers, the grinding need not be as fine as when alkali and neutral salts are used.

The action of chemical reagents as catalyzers can be explained on the assumption that calcium sulfate forms complex compounds. It is possible that the anhydrite in the presence of water and salt forms an unstable complex hydrate on its surface, i.e., the salt, $mCaSO_4—nH_2O$. This unstable hydrate then breaks up giving the dihydrate as shown in the equation: $(Salt)mCaSO_4—nH_2O \rightarrow salt + H_2O + CaSO_42H_2O$.

After the hydration follows the process of "setting." However, to explain this effect by hydration only is impossible; here, apparently, the process of *recrystallization* plays an important part. Experiments show that on standing, the added catalyzer separates out on the surface of the hard gypsum. Thus, for instance, in the experiments with anhydrite in which solutions of $NaOH$, $NaHSO_4$, $KHSO_4$ or others were used as catalyzers, it was observed that the catalyzer separated out on the surface in the form of a thin layer of crystals after the anhydrite hardened. In spite of the fact that the extent of hydration at first was slight (for instance when $NaOH$ and similar substances were used as catalyzers) the hardness of the gypsum was nevertheless considerable.

When the possibility and the conditions of the activation of inactive modifications were established, the problem was to obtain an hydrous cement for practical purposes. The term "anhydrous cement" was adopted by the Silicate Experimental Institute of Moscow where a report on this new product was made by Budnikov.

For these series of experiments, a dead modification of gypsum was used. This was obtained by burning commercial plaster of paris or the natural alabaster (alabaster is a variety of gypsum highly consolidated so that the crystals have disappeared and the mass has become translucent) and in several instances the natural anhydrite. Alkalis, acids, acid and neutral salts were used as catalyzers.

Dead-burned gypsum was ground until the powder passed completely through a sieve with 4900 openings to the sq. cm. In several experiments, however, a coarser sample was used, namely, such that 10% did not pass through the sieve. The catalyzers were added either in the form of a powder or in an aqueous solution. The total weight of water added was in most cases 35% of the weight of gypsum, while the amount of catalyzer added was from 0.1 to 6%.

The experiments which gave a maximum volume with each catalyzer are given in Table II.

The anhydrous cement obtained with sodium acid sulfate as a catalyzer has the highest density. It was tested for its ability to retain its volume in the air, in water, and in hot air (for this purpose it was placed in an air bath maintained at 120 deg. C. for 1½ hours). These tests gave very satisfactory results. This cement is also resistant to dampness. When mixed with ordinary sand (1:3) and 20% water, it gave the following results on elongation tests:

After 7 days 31.5 kgms. to sq. cm.
After 28 days 33.6 kgms. to sq. cm.
Without sand—
After 28 days 42.0 kgms. to sq. cm.

For these experiments, coarser samples of the dead gypsum were taken.

To determine the effect of the temperature of burning of the original material on the strength of the anhydrous cement formed, the following experiments were performed. Natural alabaster was burnt at 200 deg., 300

TABLE II

No. of Experiment	Added Catalyzer in per cent	Pct. Water	Tensile strength in kg. per cm. After 3 days	After 7 days	After 28 days	After 2 mos.	Fineness of Powder	Beginning of Setting
10	CaO (0.5%)	25	12.6	39.95	41.5	......	Through a sieve of 4900 openings to the sq. cm. without a residue.	After 2 hrs. with 1% of CaO.
16	CaO (3%)	35	10.5	17.5	32.5	......	Through a sieve of 4900 openings to the sq. cm. residue of 10%.	
19	$NaOH$ (1%)	35	32	29.75	40.5	......	Same as No. 10	
25	Portland cement (10%)	35	4.5	4.5	27	14.2	Same as No. 10	
30	$K_2SO_4, Cr_2(SO_4)_3+24H_2O$*	35	34.5	38.45	37.5	......		Setting very slow.
33	$(NH_4)_2SO_4$ (1%)	35	13	12.7	41.5	......		
35	Na_2SO_4 (3%)	35	15.5	8.2	38	......		
39	$FeSO_4$ (0.125%)	35	11.5	12.5	12.3	......		
45	H_2SO_4 (1%)	35	12	14.3	36.5	......		The rate of setting is higher than that of a demi-hydrate of average quality.
47	HCl (2%)	35	8.5	7.5	17	......		"
48	Tartaric acid 1% ($H_2C_4H_4O_6$)	35	7.8	23.5	36.3	......		Setting slow
53	$NaHSO_4$ (1%)	35	29.5	32.8	49.1	......		Hardens in 10-15 min.
56	$KHSO_4$ (2%)	35	27.5	33.15	50.5	......		

*This compound is prepared by passing SO_2 through a solution of $K_2Cr_2O_7$ to which some sulfuric acid was added. The action is expressed in the following general equation:

$$K_2Cr_2O_7+H_2SO_4+3SO_2=K_2SO_4, Cr_2(SO_4)_3+H_2O.$$

deg., 400 deg., 500 deg., 600 deg., and 700 deg. C. for two hours. It was then ground until the powder passed through a sieve 4900 openings to the sq. cm. and was treated with a 1% solution of sodium bisulfate. This product gave the following resistance to elongation.

Temperature of burning	Strength in kg./cm. after 28 days
200°	28.5
300°	21.8
400°	38.5
500°	49.1
600°	42.0
700°	30.0

It is seen that a burning temperature of 500 deg. C. corresponds with a maximum resistance of the product.

In determining the effect of time on the tensile strength of this cement, it was observed that in several instances the curves obtained fluctuated. An explanation of this irregularity is suggested. It is assumed that two forms of complex compounds result which are less stable than the dihydrate. This unstable hydrate slowly goes over into the dihydrate and causes the curve to rise. The process of breaking up of the first anhydrite when sodium bisulfate is used as a catalyzer is very rapid.

Microscopic investigations show that all samples have a fine grained homogeneous structure, with a few rather large inclusions here and there. These consist of the catalyzer separating out. The product, anhydrous cement, obviously is of considerable technical and economic importance, inasmuch as it can be prepared from the natural anhydrite; the only expenditure of power being that of grinding. The sodium disulfate used as a catalyzer is a very cheap product. (This process of obtaining the cement is patented by Budnikov.)

The natural gypsum, dihydrate, $CaSO_4 2H_2O$ has no application in the building industry because it lacks the quality of "setting" without preliminary burning. Budnikov and Levine obtained "gypsum cement" of considerable strength simply by grinding natural alabaster to a fine powder and treating it with a little of the catalyzer.

Natural alabaster stone was ground in a ball mill until a very fine powder was reached, which powder passed completely through a sieve of 4900 openings to the sq. cm. On dissolving this powder in aqueous solutions of different chemical reagents, the gypsum cement was obtained. In Table III are given the results of experiments on the resistance to elongation of gypsum cement obtained with sodium bisulfate and sulfuric acid in a 20% water solution.

TABLE III

No. of Experiment	Quantity added, $NaHSO_4$ in per cent	Resistance to elongation in kg./cm. After 3 days	After 7 days	After 28 days
1	0.3	9.8	38.5	70.0
2	0.5	15.2	29.7	41.5
3	1.	10.7	22.2	33.7
	H_2SO_4 in %			
1	0.5	16.5	34.0	......
2	1.	......	17.8	......
3	2.	6.0	8.0	......

A gypsum cement obtained with sodium acid sulfate as a catalyzer gives a dense mass, is quite resistant to dampness, retains its volume and can be mixed with sand.

The preparation of anhydrous cement from the insoluble modification of $CaSO_4$ under the influence of catalyzing agents led to the preparation of gypsum cement in a similar way. Calcium sulfate first hydrates and then the dihydrate formed recrystallizes. It follows, therefore, that when chemical reagents act on the fine powder of the dihydrate, recrystallization also must take place. This was corroborated by experiments.

Artificially prepared gypsum dihydrates in the form of thin prisms were ground fine in an agate mortar and then the powder was placed on a microscopic slide. One part was moistened with distilled water and another part with a 1% solution of $NaHSO_4$. Observations during several weeks under the microscope showed that gypsum treated with distilled water remained without any change for at least during the period of experimentation (five weeks).

Work of U. S. Bureau of Mines on Hydration of Anhydrite*

By Marie Farnsworth

Research Assistant, Nonmetallic Minerals Experiment Station, Bureau of Mines, New Brunswick, N. J.

ALTHOUGH anhydrite ($CaSO_4$) exists in nature in fairly large quantities, so far there has been very little outlet for this mineral. It occurs in most gypsum mines to a certain extent and in some to a very large extent; it also occurs as a by-product in the manufacture of certain chemicals. Anhydrite cannot be used for any calcined products; it is sold to a certain extent, mixed with gypsum, as a retarder for cement, but opinion is divided as to whether or not it is suitable for this use. There is a small outlet for it in the form of land plaster, but this industry is not large.

The desirability of developing some process whereby anhydrite might be hydrated to gypsum and thereby rendered available for use in calcined products led the Bureau of Mines to undertake a study of the problem at its Nonmetallic Minerals Experiment Station. Owing to lack of fundamental data the experimental work involved a study of the physical and chemical properties of the calcium sulfates.

Early Experiments on Hydration

Definite proof has been given that anhydrite will change into gypsum by simply standing with water. Gill[1] found that both anhydrite and dead-burned gypsum had set, after six years' standing with water, the dead-burned gypsum more completely than the anhydrite. The latter was approximately fine enough to pass through a screen with six or eight meshes to the inch and in six years had taken up about 8.29% moisture, which corresponds to about 34.15% of the original anhydrite hydrated. McCaleb[2] has also published a short paper on the hydration of anhydrite, but his data are very indefinite and incomplete. He took a fine powder—just how fine he does not say—wet it thoroughly in an atmosphere saturated with moisture, and observed the rate of hydration over a period of 36 weeks. From these data he assumed that hydration would be complete in about two years.

Catalysts have been found to speed up the hydration of anhydrite ot gypsum. By means of catalysts anhydrite can be made to set fairly rapidly. The process is illustrated commercially in Keene's cement, where alum is commonly used as an accelerator. However, the product obtained is very different from ordinary plaster, being much harder and much slower setting. Rohland[3] has studied the solubility and hydration velocity of calcium sulfate, and has concluded that the rate of hydration is increased by the addition of substances which render it more soluble and decreased by those which lower its solubility. The action of catalysts is only capable of commercial application in a very limited degree.

Hydration by Means of Pressure

The action of gypsum and anhydrite under pressure has been studied very little. As long ago as 1865, Hoppe-Seyler[4] found that if gypsum were heated in a closed tube to a temperature of about 130 deg. C., needle-like crystals of the hemi-hydrate were formed.

*Abstract from *Industrial and Engineering Chemistry*, Sept., 1925.

[1] *J. Am. Ceram. Soc.*, 1, 65 (1918).
[2] *Am. Chem. J.*, 11, 34 (1889).
[3] *Z. Elektrochem.*, 14, 421 (1908).
[4] *Ann. Physik.*, 127, 161 (1865).

The pressure at 130 deg. C. is only about 1.5 atmospheres, and since he did not carry his experiments to higher temperatures, his results are not very conclusive. From a study of the volume relations of gypsum and anhydrite, it appears that gypsum should be the stable form under high pressure. One thousand grams of gypsum occupy a volume of 431 cc., since gypsum has a density of 2.32; this weight of gypsum decomposes to give 791 grams of anhydrite and 209 grams of water. The anhydrite, having a density of 2.96, would occupy a volume of 267 cc.; the total volume would thus be 476 cc. Therefore, since the combined volume of the anhydrite and water is more than the volume of the gypsum, pressure should tend to form gypsum from anhydrite and water. In the two-component system, anhydrite and water, and three phases, solid, liquid, and vapor, from the phase rule $P + F = C - 2$, F must equal one, or there can be only one variable; that is, if one varies the temperature, the pressure must vary with it.

The method of testing the effect of high temperature and pressure on gypsum and anhydrite in the Bureau of Mines laboratory was as follows:

The solid—either gypsum, artificial anhydrite, natural anhydrite, or precipitated anhydrite—was sealed in a test tube with an equal volume of water so that a liquid phase was always present. Very heavy Pyrex test tubes were used to withstand the pressure. The tubes were then heated in an oven for 48 hours at temperatures varying in steps of 10 deg. from 100 deg. to 210 deg. C. They were then opened, the water filtered off, and the solid dried for several hours at 45 deg. C. to remove surface moisture. To determine the combined moisture, the solid was heated to a constant weight in a platinum crucible at about 250 deg. C. The gypsum used was chemically pure selenite ground to 200 mesh; the artificial anhydrite was prepared from the selenite by heating it to constant weight at 450 deg. C.; the natural anhydrite was a very pure sample supplied by the United States Gypsum Co. from their mine at Gypsum, Ohio, analyzed 93.59% anhydrite, and was ground to 200 mesh; the precipitated anhydrite was an analyzed sample from Baker and Co. On heating the three samples of anhydrite as described above at temperature from 100 deg. to 210 deg. C. in steps of 10 deg., practically no change in moisture content was observed. The samples did contain a small amount of water, from 0.2 to 0.5%, and after heating to about 120 deg. C. the amount decreased somewhat. This decrease was not regular and was too small in amount to be conclusive.

The same experiments were then repeated, using gypsum instead of anhydrite. At 100 deg. C. no change was observed; at 110 deg. C. about one-half the gypsum changed to needle-like crystals of hemihydrate; at 120 deg. C. the change into the needle-like crystals of the hemihydrate was complete. This continued until 160 deg. C., where the material changed into anhydrite; from 160 to 210 deg. C. anhydrite was the product obtained.

In all these tests the water was in contact with the solid. On putting the solid in a smaller test tube inside the sealed one so that it was in contact with the vapor phase but not with the liquid phase, no difference was observed except that the equilibrium was reached somewhat more slowly. Assuming that the pressure in the tube is that of pure water—an assumption that is practically correct owing to the very small solubility of anhydrite and gypsum—160 deg. C. corresponds to a pressure of about 6 atmospheres and 210 deg. C. to a pressure of about 19 atmospheres.

The above shows that a pressure of 19 atmospheres has no effect on anhydrite and water under high temperature conditions. In fact, dehydration of gypsum with rising temperature takes place practically the same in the tube as it does at atmospheric pressure. This is not a surprising result considering that anhydrite is the stable form above 60 deg. C. These results bear out those of van't Hoff,[5] who measured the vapor pressure of the water of crystallization of gypsum in equilibrium with the half-hydrate at different temperatures by a number of ingenious methods. From these measurements it would appear that the vapor pressure of gypsum in forming half-hydrate becomes equal to one atmosphere at 101.45 deg. C., while at 107 deg. C. the vapor pressure of the water of crystallization of gypsum becomes greater than the vapor pressure of the water itself. The temperature of 107 deg. C. is, therefore, the transformation point of gypsum into half-hydrate when in contact with water; that is to say, when gypsum is heated (under pressure) with water to a higher temperature than 107 deg. C., the half-hydrate should be formed; below 107 deg. C., water should convert the half-hydrate into gypsum. In the presence of aqueous solutions having a lower vapor pressure than water the temperature of transformation of gypsum into half-hydrate is lowered.

These tests indicate that anhydrite cannot be hydrated under conditions of high temperature and pressure.

Hydration by Fine Grinding

As there is strong evidence that large particles of anhydrite hydrate slowly in nature to form gypsum, and that anhydrite can be made to hydrate slowly in the laboratory by simply standing with water, it seemed reasonable to suppose that the process could be speeded up by increasing the surface area exposed to the action of water. Accordingly, the rate of hydration of fine particles of anhydrite was observed.

Sample A, the coarsest size tried, was obtained from Gypsum, Ohio. It contained 93.59% anhydrite, the impurities being a little gypsum, calcium and magnesium carbonates, and silica. It was ground in an ordinary pebble mill to about 100 mesh. The particles when examined under the microscope were found to vary in size from 135 microns to colloidal size with an average size of about 18 microns; and containing many particles in sizes varying from 30 to 40 microns. The sample was mixed with a considerable excess of water and agitated from about 8 a.m. to 5 p.m. each week day. At first the sample took up about 2% moisture each week, but later the rate slowed down considerably and time was not allowed for complete hydration. Evidently, the smaller particles hydrate quite rapidly, and then the process is slowed up by the presence of the larger particles which hydrate much more slowly.

Sample B was a part of Sample **A** anhydrite, but was more finely ground in the pebble mill to about 150 mesh. Under the microscope it showed a maximum size of about 96 microns, an average size of about 12 microns, and many particles in sizes varying from 20 to 30 microns. It hydrated much more rapidly than Sample **A**, but in the same manner—that is, more rapidly at first and then increasingly slower. Complete hydration was attained in about 13 weeks. Although this rate is considerably in excess of any heretofore recorded, it is not sufficiently rapid to be of any practical importance, so methods of finer grinding were tried.

Sample C was part of the same sample of anhydrite that was used in **A** and **B**, but it was ground in the colloid mill of the Premier Mill Corporation, Geneva, N. Y. The particles when examined under the microscope were found to vary in size from 75 microns down to colloidal size, with an average particle size of about 10 microns; the sample contained many particles in sizes varying from 10 to 40 microns. Hydration first proceeded quite rapidly and then slowed down considerably so that about 18.5% moisture (19.5% moisture corresponds to complete hydration for this sample) had been taken up in 10 weeks. Complete hydration would have taken somewhat longer, as the rate of hydration by this time was quite slow. After 10½ weeks, the sample was dried and used for tests which will be discussed below.

Sample D was a second sample of anhydrite from Gypsum, Ohio, analyzing 91.36% anhydrite, also ground in the Premier colloidal mill. It was somewhat more finely ground with a maximum particle size of 45 microns and an average of about 9 microns. Hydration proceeded quite rapidly at first, but owing to the large number of rather large particles is slowed down considerably and complete hydration was not attained until about 9 weeks.

Sample E, part of the same sample of anhydrite as was used in **D**, was ground in an ordinary pebble mill, first dry to about 200 mesh and then wet. The maximum particle size of the finished product was about 35 microns, the minimum colloidal, with an average particle size of about 8 microns. The material was uniform in size. This sample hydrated very rapidly and complete hydration was attained in about 4 weeks. At first the rate of hydration was about the same as that of Sample **D**, but it maintained a much more rapid rate until complete hydration as there were comparatively few of the larger sized particles present.

All of these samples, with the exception of Sample **C**, were agitated during each week day, but Sample **C** was only agitated once a week when a sample was removed to test for moisture content. A comparison of the rates of hydration shows that agitation cuts down the time required for hydration by about 20%. If the sample were agitated continuously rather than during the day only, the rate of hydration would be increased even more.

Sample F consisted of anhydrite obtained as a by-product in the manufacture of hydrofluoric acid from fluorspar by the action of sulfuric acid. The material as obtained was very well crystallized, with a maximum particle size of about 70 microns and an average of about 9 microns. Its rate of hydration was found to be exceedingly slow; although it had the same average particle size as Sample **D**, it had taken up only 1% moisture after one week, whereas Sample **D** had taken up 10%. The sample was then ground wet for a short time in a pebble mill, after which the well-defined crystals were found to have been broken down, the maximum particle size decreased to about 30 microns, and the average particle size to about 7 microns. This material is designated Sample **G**. Its rate of hydration was then more rapid than any of the other samples tested, complete hydration being attained in about three weeks. This increase is, of course, out of all proportion to the decrease in particle size. Evidently, the crystalline form is a factor as well as the particle size, the abrasion or roughening of the crystal faces causing a marked increase in the rate of hydration. Some evidence was obtained in this test that the hydration is at least to some extent a process of solution, and reprecipitation for the hydrated substance was again well crys-

[5] van't Hoff and Armstrong, *Sitzb Akad. Berlin*, 1900, 563.

tallized, with an average particle size of 17 to 18 microns, therefore much coarser grained than before hydration.

The tabulation of the results from these experiments is shown in Table I.

TABLE I

Sample	Average particle size, microns	Time of hydration, weeks	Per cent hydrated in 3 weeks
G	7	3	100
E	8	4	75
D	9	9	33.33
C	10	11	27.27
B	12	13	23.07
A	18	18	14.44

These results indicate that the hydration of anhydrite is greatly facilitated by fine grinding and the abrasion of crystal surfaces, and that the rate of hydration is further increased by agitation of the fine particles in water.

When Samples *C*, *D*, *E*, and *G* were completely hydrated or practically so, they were filtered off, dried at 45 deg. C. and then calcined to plaster of paris. Each was then tested for water-carrying capacity, setting time and tensile strength according to the standard methods of the A. S. T. M.

From the data in Table II it is seen that the hydrated material makes plaster of paris well above the specifications of the A. S. T. M., which demands a tensile strength of 200 lb. per sq. in. The material is excellent in appearance. As a retarder in portland cement its action is fully equal to that of ordinary plaster of paris and gypsum. Sample *G* was very rapid setting, owing to traces of acid left from the chemical process. This acid would have to be removed before the material could be used commercially. The tensile strength could not be tested, as the set was broken up in mixing.

TABLE II

Sample	Temp. calcination ° C.	Water-carrying capacity per 100 grams plaster grams H_2O	Unretarded setting time Minutes	Tensile Strength kg./sq. cm.	Tensile Strength lb./sq. in.
C	150	82.5	19	18.20	259.3
D	150	78.0	9	16.29	232.0
E	150	87.5	10	18.43	262.5
E	200	87.5	15	21.17	301.5
G	150	Uncertain but approximating those above	Approx. 3		

Practical Application

The hydration process described herein may be the first stage in progress toward a wider utilization of anhydrite. It has been shown that anhydrite can be hydrated by a very simple process within a reasonable period of time, and that the product can be calcined to give plaster products comparing favorably with those manufactured from natural gypsum. Immediately the question arises—Can the process be used commercially or is the cost prohibitive?

This first step which demonstrates the easy possibility of hydration is important to an extent that can be determined only by subsequent developments. It is highly desirable that commercial scale tests be made to determine the actual cost of hydration. A suggested process is tube mill grinding, followed by agitation in tanks, partial dewatering and calcination in rotary kilns in slurry form similar to the wet process of cement manufacture. Anhydrite is easily ground, no classification by size is requisite, and complete hydration is unnecessary, as the standard specifications for commercial gypsum require a minimum of only 65% $CaSO_4 \cdot 2H_2O$. The degree of hydration would probably be governed by the strength requirements of the resulting plaster. The process would seem to be particularly advantageous for dealing with byproduct anhydrite which is already in a fine-grained form, and which, because of its purity, would form a high-grade calcined product commanding a comparatively high price.

British Cement Specification

THE British Engineering Standards Association has now published a new issue of the B. S. Specification for Portland Cement which was last revised in 1920. Since that time it has been found desirable to make certain changes to bring the B. S. Specification more into line with present-day requirements and to meet prevailing conditions of manufacture and testing in hot climates. In the course of the work of revision a more precise method was sought than that heretofore adopted for determining the consistency of the neat cement paste for the tensile and setting time tests. Extensive investigations were carried out but no method was found which could be considered unquestionably more reliable and the directions of the previous editions of the B. S. Specification have therefore been retained. The investigations are being continued in the hope that some satisfactory means may be found which can be included in a future edition of this specification.

The following are the principal alterations embodied in the 1925 specification:

(1) A summary of the tests is given at the beginning of the specification.

(2) Provision has been made for testing in hot countries at temperatures up to 95 deg. Fahrenheit. In climates where the temperature runs above 95 deg. or below 58 deg. special arrangements have been made between the vendor and the purchaser unless the ranges given in the specification can be artificially produced.

(3) The cement is now required to be more finely ground, the permissible residue on a 180 by 180 sieve being 10%, instead of 14%. Tolerances are laid down for the number and size of wires and size of openings in sieves both for cement and for sand. The minimum size of the sieving area is now specified to be 50 sq. in. and the minimum depth of the sieves to be 2¾ in.

(4) The maximum figure for the hydraulic modulus has been raised to 2.90 and the maximum limit for magnesia is now 4%.

(5) The minimum tensile breaking strength of neat cement after seven days has been increased to 600 lb. per sq. in. and that of cement and sand after seven days to 325 lb. per sq. in. The 28-day test on neat cement has been eliminated.

(6) The amount of water for gauging cement and sand briquettes is now to be ascertained by means of a formula based upon the amount needed to produce the plastic mixture required in the tensile test for neat cement.

(7) The standard Leighton Buzzard sand is required to be of the white variety and its loss of weight on extraction with hot hydrochloric acid is specified not to exceed 0.25%.

(8) The initial setting time of normal setting cement is to be not less than 30 minutes, and the initial setting time of quick-setting cement not less than five minutes.

Copies of this publication (No. 12-1925) can be obtained from the B. E. S. A. Publications Department, 28, Victoria Street, London, S. W., price 1s. 2d. post free.—*The Contract Journal*, London, England.

Nature's Formation of Limestone Deposits and Caves

IN districts such as Kentuicky, perhaps a million or so of years ago, the region was covered by a sea. Sedimentary strata of limestone were deposited on the bottom and after a layer of sandstone formed on top of this. Later through some upheaval the bottom of the sea arose and became dry land. Rain water, seeping through the decaying plants on the surface absorbed carbon dioxide from them, percolated through the sandstone atop and was able to decompose the limestone, ordinarily insoluble in water. Through many centuries, an entire stratum of limestone would be dissolved leaving caverns often of great height, whose floors and ceilings were of sandstone or some other insoluble rocks. The water, charged with the carbon dioxide would dissolve more limestone from the top and hang from the ceiling in drops where the carbon dioxide was evaporated and the consequent formation of the insoluble limestone would result. This would be deposited on the ceiling and in time formed the so-called stalactites. Many of these drops fell to the floor before they gave up the carbon dioxide, carrying their small amounts of limestone. In this case the limestone was deposited on the floor when the carbon dioxide was evaporated off and a building up of tapering pillars of limestone called stalagmites occured.

Panorama of whole plant. Extreme left, furnace-stone plant; center, conveyor galleries and road-stone plant; right, in background, agstone plant and office

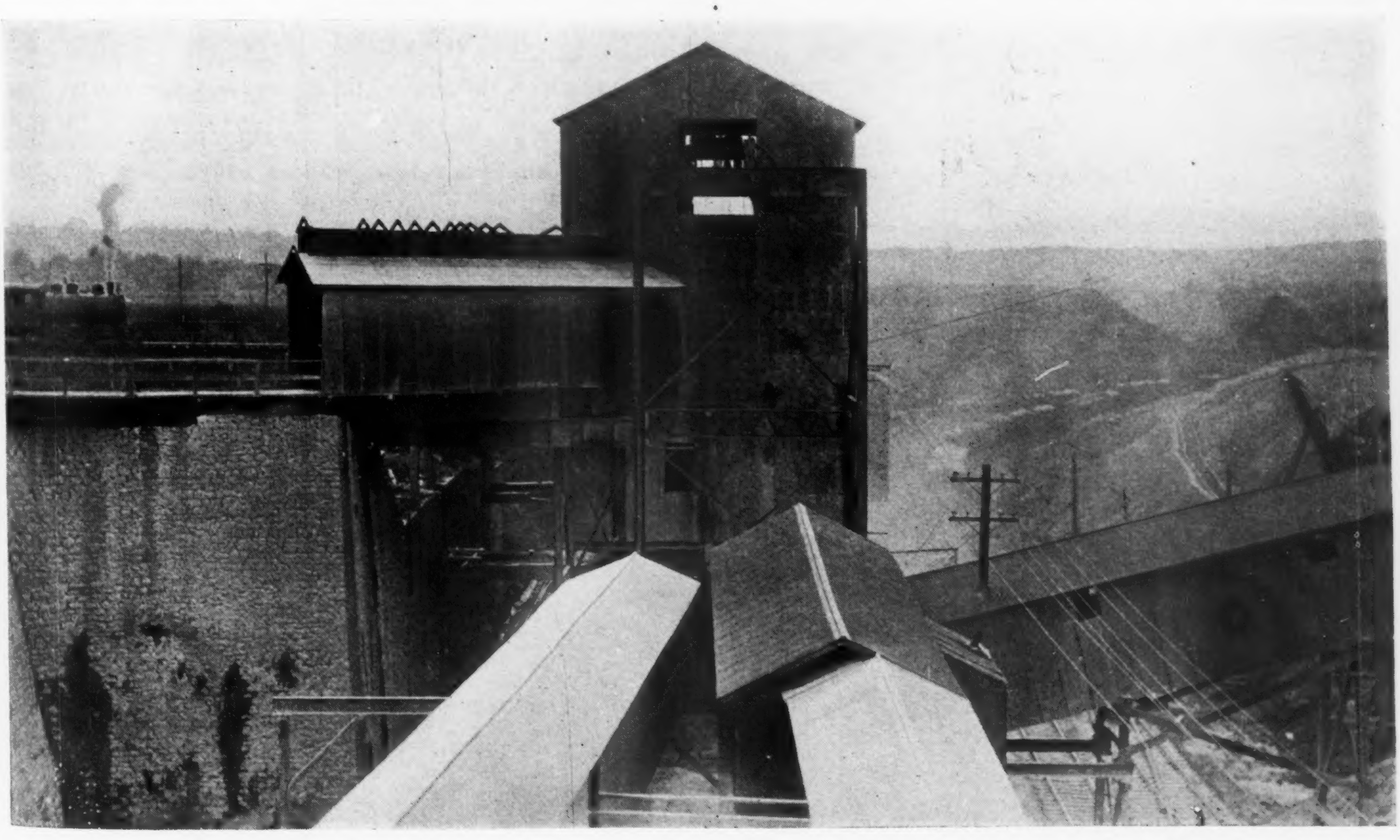
Moving 42 Feet of Overburden for 20 Feet Of Limestone—At a Profit

Carbon Limestone Company, Hillsville, Pennsylvania, Now Operating New Plant, Replacing One Destroyed by Fire Last Year—Produces Thirteen Sizes Daily Without Changing Screens—Quarry One of America's Most Efficient Operations

By Geo. M. Earnshaw

Central Representative, Rock Products

FIRE DESTROYED the road-stone plant and the agstone plant of the Carbon Limestone Co., Hillsville, Penn., on September 22, 1924. The furnace-stone plant was saved by dynamiting the conveyor galleries connecting it with the road-stone buildings, so that the plant as a whole was not entirely destroyed. Reconstruction was started immediately, and material and equipment were on the ground six weeks later. By March 1 the new plant was operating, and on May 1, this year, construction was completed in all



Furnace-stone plant as viewed from road-stone plant. Conveyor at right leads to agstone plant

Panorama view of the quarry. It is properly

Close-up of one of the reconstructed drills. It averages 300 ft. per day as compared to 175 ft. with the old method

the important details.

The new buildings are fireproof throughout, being of concrete and steel construction, and are covered, sides and roofs, with heavy sheet steel, for so far as fire is concerned, the company does not intend to let history repeat itself. The total *maximum* capacity of the three departments (road-stone, agstone and furnace-stone) is 1,500,000 tons per year; the normal output, however, is approximately 1,000,000 tons but this figure will be exceeded this year.

Furnace-Stone Plant

The furnace-stone plant has as its initial crusher a No. 21 Allis-Chalmers gyratory, belt-driven by a 150-hp. motor of the same make. From it the stone is chuted to a 42-in. belt conveyor of 185 ft. centers running at an inclination of about 16 deg. This belt empties on a second belt of the same width, length and incline, carrying the stone in the opposite direction, back to the screens, which are mounted on about the same level as the receiving hopper of the No. 21 crusher.

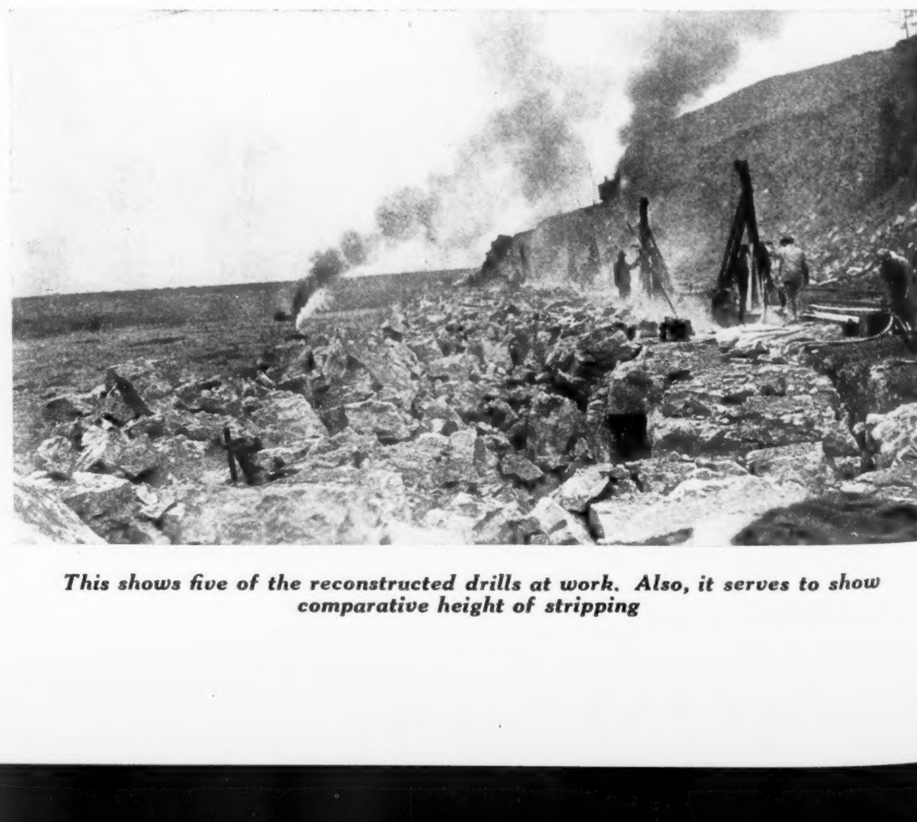
The two screens are side by side and the flow of stone from the conveyor is split to feed them equally. The screens are 4 ft. in diameter and 16 ft. long, with 5-in. openings their full length. Each is equipped with a 7-ft. diameter by 12-ft. long jacket with 1¼-in. openings. The rejections of the screens are chuted to a No. 8 crusher, the product of which is fed to the 42-in. conveyor leading to the screens. Stone passing through the 5-in. openings and retained on the 1¼-in. screens drops into two bins directly under the screens, and is loaded out and sold as furnace stone.

The two 42-in. belt conveyors, the two screens and the No. 8 crusher are all belt-driven by one 175-hp. Allis-Chalmers motor. The belts are of the Republic Rubber Co.'s manufacture and are mounted on Stephens-Adamson ball-bearing idlers. There is a total of more than 6000 lin. ft. of transmission and conveying belting in the plant.

Stone passing through the 1¼-in. screens is conveyed on a 24-in. belt, mounted on Jeffrey idlers, to a 36-in. belt and thence to a 30-in. Manhattan Rubber Co. belt, also mounted on Jeffrey idlers, which leads to either the agstone plant, washing plant or outside storage. A flop-gate is provided in the chute from the No. 21 crusher so that any part of the No. 21 "crusher run" can be diverted by belt conveyor to the road-stone plant.

Road-Stone Plant

There are three Allis-Chalmers gyratories in the road-stone plant, a No. 12, No. 7½ and a No. 6. The No. 12 is driven by a 100-hp. Allis-Chalmers motor and the Nos. 7½ and 6 are each driven by a 50-hp. Western Electric Co. motor. Cars of stone are dumped directly into the No. 12 crusher, which discharges into the boot of a 36-in. belt-bucket elevator of 87 ft. centers. The belt conveyor from the furnace stone plant discharges on a flat woven wire screen with



This shows five of the reconstructed drills at work. Also, it serves to show comparative height of stripping

properly well equipped and represents an ideal operation

The track-shifter in action. This view shows it preparing to lift

4-in. openings and only the rejections of this screen are passed to the Nos. 7½ and 6 crushers. The remainder is chuted to the 36-in. elevator. (The flat screen is to be replaced with a revolving screen this winter.)

The screening arrangement of the road-stone plant is most unusual, for here 11 distinct sizes can be produced without the necessity of changing screens. These are: Dust to ⅛ in., dust to ¼ in., dust to ½ in., dust to ⅝ in., ⅛x⅜ in., ⅜x⅝ in., ⅝x1¼ in., ⅝x2¾ in., 1¼x2 in., 1¼x3 in. and 2x4 in. These 11 sizes plus the furnace stone and sacked pulverized limestone make a total of 13 different sizes produced without changing screens.

The primary screening unit in the road-stone plant is a revolving screen, 7 ft. in diameter by 26 ft. long, made up of five sections. The first three sections have 1¼ in. openings, the fourth section 2 in. openings and the third 2¾ in. openings. Mounted over this is an outer screen jacket, 12 ft. long, having ⅝ in. openings. Fines passing through the ⅝ in. screen are chuted to a rotary screen, 4 ft. in diameter by 15 ft. long, fitted its full length with 5/16 in. woven-wire cloth. Rejections of this screen are chuted to bins. Fines passing through it are carried on an 18 in. belt conveyor of 50 ft. centers to a flat, sharply inclined woven-wire screen with ¼ in. openings. The product of this screen is sold as screenings, while the rejections are conveyed to the agstone plant.

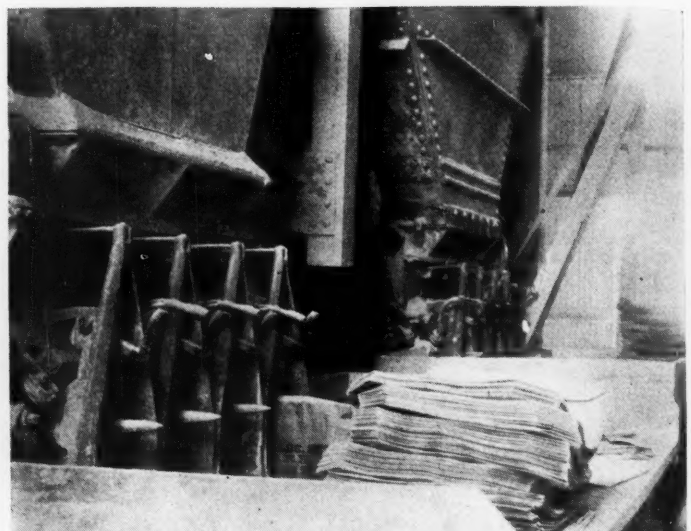
The belt bucket elevator serving the rotary screen, the big screen itself, the 18 in. conveyor and the small revolving screen are all driven by one motor, a 75-hp. Western Electric. The rejections from the large screen are chuted to the Nos. 7½ and 6 crushers. Blending of the different sizes is accomplished by an elaborate system of chutes and flop gates, and it is possible to accurately blend any two, or more, products of the primary screen.

Agstone Plant

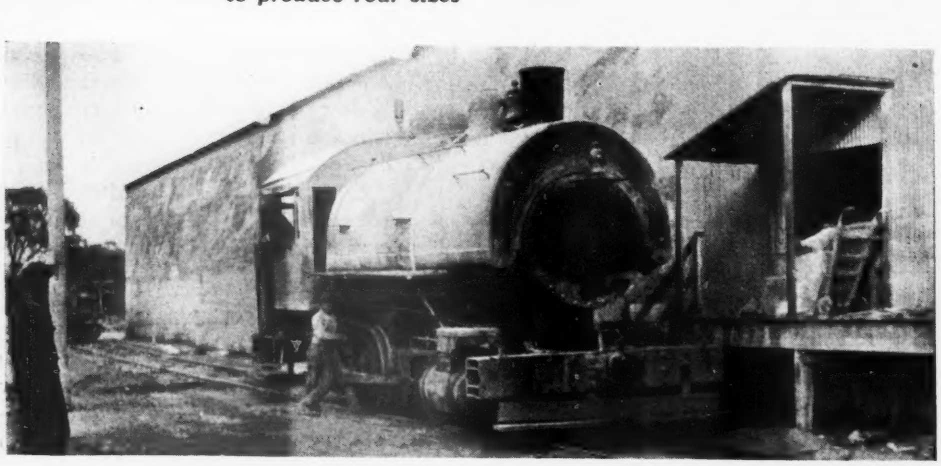
The ½ in. and under stone is received in the agstone plant from the 30 in. conveyor in two bins mounted over two 6x60 ft. Allis-Chalmers coal-fired rotary dryers, each driven by a 35-hp. Allis-Chalmers motor. Stone is fed to the dryers by ordinary shuttle feeders furnished with the dryers. Before being elevated (in an 18 in. Jeffrey enclosed chain bucket elevator) to the bin above the grinding mill, the dried stone is passed under a small lifting magnet, which removes all tramp iron. There is so much tramp iron that it is necessary to clean the

The track-shifter in action. This view shows the track being lifted, preparatory to being thrown over

This home-made washing plant really washes: is equipped to produce four sizes



The two 4-valve baggers in the 600-tons-per-day "agstone" plant



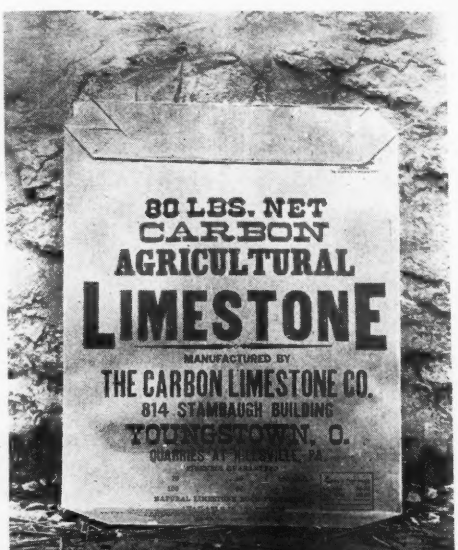
This 62-ton standard-gaged locomotive does general yard duty about the plants

A 25-ton locomotive crane loads and unloads coal and stone

magnet four times each day. This feature entirely removes the hazard of torn screens in the grinding mill.

There is but one grinding unit in the plant. This is a Bradley "Hercules" mill, direct-connected to a 300-hp. Allis-Chalmers slip-ring motor. It has a rated capacity of 40 tons per hour. The mill discharges into an enclosed chain bucket elevator which empties into a 12 in. spiral conveyor through a 14-mesh revolving screen. This screen is an extra precaution against tramp iron that may have entered into the product after leaving the mill. A sampling chute from this point, which can be discharged within easy access of the mill operator, is installed so that a check can be made at any time to determine whether or not the grinding-mill screen has been torn.

There are two storage rooms for the pulverized limestone, of concrete construction throughout. They are each 34 ft. wide, 26 ft. high and 150 ft. long, having a capacity of 6000 tons each. Each room, or bin, has two 12 in. underground reclaiming screw conveyors. These discharge into cross conveyors which discharge into either of two enclosed chain bucket elevators serving the storage bins over the packers. There are two four-tube Bates packers with a 30-in. belt conveyor for each, running opposite directions, so that cars on both sides of the building can be loaded simultaneously.



How the Carbon company puts up its agricultural limestone

In addition to the storage bins mentioned above, there is also a 120 ton capacity bin of concrete construction, at the end of the agstone plant, for accommodating the wagon and truck trade. This bin also is filled by 12-in. spiral conveyors, of which there is a total of approximately 800 lin. ft. throughout the plant, furnished by the Stephens-Adamson Manufacturing Co. and the Jeffrey Manufacturing Co.

Washing Plant

Four sizes of stone can be put through the washing plant, which is of home-made construction and design, used only upon occasion. These sizes are $\frac{1}{8}$x$\frac{3}{8}$ in., $\frac{3}{8}$x$\frac{5}{8}$ in., $\frac{5}{8}$ x $1\frac{1}{4}$ in. and dust x $\frac{1}{8}$ in., which is sold as sand. The plant is fed by an 18-in. belt conveyor of 150 ft. centers, driven by a $7\frac{1}{2}$-hp. Allis-Chalmers motor. This belt is fed by the belt serving the agstone plant, which runs from the road-stone plant. The

plant consists of a 4x16 ft. revolving screen with 5/8 in. openings. Over this is a jacket 12 ft. long with 5/16 in. holes, and over this is a jacket 8 ft. long with 1/8 in. openings. A 3 in. water line, mounted in a roller bearing collar, extends through the center of the screen. The bottom side of the pipe is perforated in such a way as to allow a proportionately larger spray at the receiving end than at the discharge end. The stone is discharged from the screen into three 12 in. spiral conveyors with perforated bottoms and the water is flumed to a sediment basin. There are three loading tracks at the washing plant. One runs directly under it and one on either side of it. Water is supplied the plant by an Austin mine pump driven through Morse chain drive by a 15-hp. Western Electric motor.

Miscellaneous Features

On the company's property in close proximity to the plants is the plant of the Interstate Amesite Co., which prepares "Amesite" (a cold mixed stone and asphalt). This plant requires an average of 500 tons of stone per day. The Carbon Limestone Co. delivers this company's requirements in dump cars hauled by a 62-ton Porter locomotive.

A model 36 Marion revolving steam shovel takes care of the reclaiming of stored limestone, of which the company has several hundred thousands of tons. A 25-ton Brownhoist locomotive crane operates all about the plant in unloading and storing stone and coal. It is worthy of mention that the company has a 30-in. vein of coal overlying its stone, which is profitably mined and consumed by the locomotives and steam shovels. Coal for use in the company dwellings and stone dryers only is purchased. The whole operation consumes 80 tons daily, of which about 70 tons is mined on the property.

Water for general use is pumped from a creek about one-half mile from the quarry by an 8x12-in. Fairbanks-Morse pump driven by a 20-hp. Allis-Chalmers motor through a 5-in. line to tanks in the quarry for steam shovels and locomotives. There are also two Austin booster pumps in the quarry, each driven by a 5-hp. Western Electric motor through Morse chain drive. In addition, there is a 10-in. Swaby centrifugal pump for draining the quarry. This pump is driven by a 40-hp. Western Electric motor through Morse chain drive. Throughout the plants and quarry there are a total of 36 electric motors, ranging from 1/4 to 300 hp.

Air for the entire operation is supplied by two Ingersoll-Rand "Imperial" Type 10 compressors, each driven by a 200-hp. Allis-Chalmers motor through Lenix drive. The main line from the compressors is 8 in. and is branched off into a 6 in. and 4 in. line so that there is always a line in service.

Machine Shop and Round-House

The machine shop at this plant is unusually well equipped for a crushed stone operation. However, it is only as it should be, considering that there are eight steam shovels, a locomotive crane, a gasoline crane, 26 steam locomotives, a track shifter and more than a hundred and fifty cars to be kept in repair, to say nothing of the equipment inside the plants.

All the machines are driven from a single line shaft, powered by a 30-hp. General Electric motor. The equipment includes: One 90-ft. Chicago Pneumatic Co. air compressor; four riveting and chipping hammers; three air drills; one 48-in., two-spindle, lathe; one 12-in. shaper; one drill press; one 200-ton hydraulic press, for pressing

Fred O. Earnshaw, general manager

quarry car wheels on and off; one Sullivan drill sharpener; one 12-in. lathe; one Erie air hammer; three Buffalo forge blowers; five Oxweld welding and cutting outfits, and one 250-amp. Lincoln electric welding outfit, mounted on a 36-in. gage car, for electric welding flues in fireboxes of locomotives and steam shovels.

The round-house is of sufficient size to accommodate the maximum number of locomotives that are off duty at any one time. Every provision for efficient locomotive repairing has been made in the round-house. Adjoining it is a car repair shop which is equipped with every piece of wood-working machinery required in the complete building of a car, also overhead cranes and drill presses, for the company builds all of its quarry cars under patent rights owned by its general manager, Fred O. Earnshaw.

The Quarry

The Carbon Limestone Co.'s quarry is one of the finest, if not the finest, in America, from the standpoint of efficiency, cleanliness and method of general operation. Its chief advantage is the fact that it has a straight face, approximately 4000 ft. long. Its chief disadvantage is its heavy overburden. With such an overburden many operations have failed. To keep going—at a profit—with prices of stone as low as they are requires unusually careful management with considerable thought on how to keep production costs down. There are several places in the Carbon company quarry where this has been done.

There is approximately 20 ft. of stone. This is overlaid with an average of 42 ft. of shale and dirt. It sounds almost impossible to quarry that 20 ft. of stone at a profit, but it is being done. The shale and dirt are separated by a 30-in. vein of coal. The shale averages about 30 ft. and the dirt about 12 ft. By stripping first the dirt and mining the coal in stripping fashion, and then stripping the shale, the entire stripping operation is being done economically, because of the saving in coal bills.

Attempts to lower costs do not end there, however. To dispose of such a great amount of overburden, even after it is stripped, is costly. There are four trains of 12-yd. dump cars moving continuously, requiring large crews of men at the dumps. Dumping costs—which are a big part of the total production costs—were lowered considerably by the installation of a track shifter, for it released many men from duty on the dumps. The Carbon company was the first limestone company to try it, but they were forced to experiment because costs *HAD* to be lowered in order to carry on.

Another operation contributing to high production costs was the stone drilling. (The overburden is drilled by Cyclone and Keystone blast-hole drills, which method is conceded to be most efficient for a 40 ft. deposit.) Denver tripod rock drills had always been used for the stone drilling, however, and the management had always considered the changing of drill steels every 2 ft. as excessively expensive. After considerable experimenting, the present method was worked out, and now the drill steel is changed only every 7 ft. A high record with the old method was 200 ft. per day, the average being 175 ft. The Carbon company drillers are now averaging 300 ft. per day per drill.

This was done by doing away with the tripod and shell of the drill and mounting the bare cylinder on 11-ft. channel irons with specially made iron slots, bolted on. The mast was provided with a pulley at the top over which a cable was passed to support the drill. The other end of the

cable was attached to a winch mounted on the base of an A-frame which holds up the mast. The base of the A-frame and the bottom of the mast were then mounted on a sort of V-shaped iron plate, about 3x3½ ft. by 1 in. thick, which in turn was mounted on an axle with a pair of 30-in. steel wagon wheels. This provided for mobility and reduced the time required in getting from one hole to another, with results in footage as mentioned above. These are but two recent contributions to cost lowering at the Carbon company plant.

Shipping

The dirt is stripped by a Model 60 and a Model 76 Marion shovels, hauled to the dump in 4-yd. Western cars by 20-ton steam locomotives. (There are 26 locomotives in all, Vulcan, Porter and Davenport.) The shale stripping is done by model 76 Marion and one Model 100 Marion and the shale is hauled to the dump by four trains of 12-yd. Western air-dump cars. The track shifting and raising is done by a "Peterson" shifter, made by the Nordberg Manufacturing Co., Milwaukee.

Stone is loaded by two Model 76 Marion shovels mounted on crawler treads and one Model 80 Marion. The stone is hauled by eight trains, eight cars each, over 38-in. gage track. The length of the round trip, quarry to plant and return, is three miles.

Personnel

The Carbon Limestone Co.'s payroll carries about 300 names. During normal operation about 275 men are required in the day shift and 25 for the night shift. The company has its own community (commonly called Quaker Falls), owning houses and farms for its employes and operating a commissary for their convenience. Each house is provided with running water, electricity and its own garden plot.

Safety for employes is the most important consideration around the Carbon company's properties, and it is safe to say that this company is one of the first quarry operations in this country to engage in safety work.

ROCK PRODUCTS editors were therefore not surprised to see the company strongly represented at the first meeting of the Quarry Division of the National Safety Council, held in Cleveland, the last week in September.

The officers and operating personnel of the company are as follows: Robert Bentley, president; M. S. Logan, secretary-treasurer; Fred O. Earnshaw, general manager; J. C. King, sales manager; J. H. Jackson, superintendent of operations. The general offices of the company are at 814 Stambaugh building, Youngstown, Ohio. Mr. Earnshaw and Mr. Jackson have their offices at the plant, Hillsville, Penn.

Investigation of Reasons for Difference in Strength of Concrete From Two Paving Projects*

By C. L. McKesson

Testing and Research Engineer, California State Highway Department

THE highest average strength of field concrete from a California paving project, laid and tested during the season of 1924, was about 5000 lb. The lowest average strength from a project built during the same season was about 2700 lb. On each project, the same amount of cement per cubic yard was used.

Believing a study of the reasons for this wide variation in strengths would be of value in connection with efforts of the department to produce uniformly good concrete, liberal samples of materials used on each project were secured and a complete series of laboratory tests, which seem most illuminating, have been completed.

In the following report of this research the paving project having the higher strength will be designated as Number 1, and the one with the lower strength as Number 2. Materials used on the two projects likewise will be designated by the same numbers; Sand No. 1, Gravel No. 1, and Cement No. 1 being those used on project No. 1, and Sand No. 2, etc., referring to the materials used on the lower strength project No. 2.

The projects were many miles apart and all of the materials were from different sources. All of the materials, however, tested within our specification limits and therefore were acceptable.

Many Investigations Necessary

To remedy defects in the design of concrete, the various elements must be investigated, one at a time. Therefore, in this series of tests, specimens were made using cements and aggregates in all possible combinations in order to show clearly the variation in strength due—

1. To the difference in the quality of the sand.
2. To the difference in the quality of the gravel.
3. To the difference in the quality of the cement.

In mortar tests, No. 1 sand, as used in the paving work, gives a strength ratio of 123. No. 2 sand, used as in pavement, had a strength ratio of 104. This difference in strength ratios is reflected in the tests of concrete, as shown in the following table:

TABLE 1.
Variation in Strength of Concrete Due to Difference in Quality of Sand

Made with	No. 2 Sand	No. 1 Sand	Pounds No. 2 weaker than No. 1
No. 2 Cement, No. 2 Gravel	3141	3382	241
No. 2 Cement, No. 1 Gravel	3431	3739	308
No. 1 Cement, No. 2 Gravel	4202	4438	236
No. 1 Cement, No. 1 Gravel	4260	4711	451
Average	3760	4070	310

No. 2 gravel, crushed, recorded a loss of 19% in the shot rattler. No. 1 gravel, not crushed, in the shot rattler shows a loss of 10.2 to 11.5%. A somewhat higher rattler loss is expected with partly crushed gravel, but the test indicates that No. 2 gravel is somewhat weaker than No. 1 gravel. That there is a difference in strength of concrete made with each gravel, is apparent from the following table:

TABLE 2
Variation in Strength of Concrete Due to Difference in Quality of Coarse Aggregates

Made with	No. 2 Gravel	No. 1 Gravel	Pounds No. 2 gravel weaker than No. 1
No. 2 cement, No. 2 sand	3141	3431	290
No. 2 cement, No. 1 sand	3382	3739	357
No. 1 cement, No. 2 sand	4202	4260	58
No. 1 cement, No. 1 sand	4438	4711	273
Average	3790	4035	245

The following table shows the difference in strength of concrete on the two jobs directly attributable to the difference in quality of cement:

TABLE 3
Variation in Strength of Concrete Due to Difference in Quality of Cement

Made with	No. 2 Cement	No. 1 Cement	No. 2 cement weaker than No. 1
No. 2 sand, No. 2 gravel	*3141	4202	1061
No. 2 sand, No. 1 gravel	3431	4260	831
No. 1 sand, No. 1 gravel	3739	**4711	972

*October issue of "California Highways."

No. 1 sand, No. 2 gravel	3382	4438	1056
Average	3423	4402	980

*This cement, sand and gravel gave average strengths of 2675 pounds on paving project No. 2.
**This cement, sand and gravel gave average strengths of about 5000 pounds on paving project No. 1.

Conclusion

1. Of the difference in strength of concrete on the two projects:

Table 1 shows sand to be responsible for 290 lbs. sq in. 18%

Table 2 shows gravel to be responsible for 241 lb. sq. in. 15%

Table 3 shows cement to be responsible for 1060 lb. sq. in. 67%

Total difference traceable to material—1591 lb.

Actual difference in concretes made in laboratory with accurate control of water and uniform manipulation..................1570 lb.

Actual difference in field concretes from the two jobs about..............................2300 lb.

Difference due to excess water and other variations about.......................................700 lb.

2. By regrading the sand to a coarser curve, some of the difference due to low strength ratio of sand might have been eliminated. (Reference in this connection is made to tests of materials for another paving project, recently reported, in which 200 to 300 lb. was added to the strength of sand by regrading to a coarser curve.)

3. No. 1 sand and gravel can be considered of as good a quality as can reasonably be expected under favorable conditions. By bringing the quality of sand and gravel on the No. 2 job up to the quality of project No. 1 material, and by most accurate control of water in the mixture, the strength might have been increased about 1230 lb. By substituting a stronger cement 1060 lb. might have been added.

4. This series indicates it is possible to predetermine the quality of concrete to be produced with any given combination of aggregates of a known quality. It also indicates the water cement ratio and the fineness modulus are not the only consideration in the proper design of concrete.

Magnesite Production in Venezuela

(Consul D. C. McDonough, Caracas)

THE magnesite deposits of Venezuela are situated on the island of Margarita, which lies north of the mainland, about 200 miles from the port of La Guaira. Because of litigation there has been no production since 1921, but it will probably be resumed soon on the principal deposits. These are owned and worked by United States interests and it is their intention to have a monthly output of 1500 long tons of pure magnesite.

No Concessions Needed—Two Principal Deposits

No concessions have ever been given by the government of Venezuela to work or calcine magnesite. Under the national law the workings are quarries and not mines.

The two principal magnesite deposits on the island are La Loma de Guerra and La Constanza, both under lease to an American company, the former until 1937 and the latter until 1935. The La Constanza property is generally considered not very valuable, as the deposits appear to be small and to contain much silica. This opinion is disputed, however, and the statement has been made that 100,000 tons of magnesite are in sight. So far, however, not much appears to have been quarried here, and all work was stopped in November, 1916.

The La Loma property contains more than 200 acres, but the actual deposits do not appear to cover nearly all that territory. It is favorably situated for exploitation on a large scale at low cost, covering a series of hills which development indicates are composed largely of a magnesite formation. It is said that there is a large tonnage of magnesite in sight, and that the veins are larger and better as greater depths are reached. Before suspension of work, a minimum output of 1000 tons monthly was reported easily accessible at La Loma, with possibilities of increase to 2000 tons or more.

All Magnesite Exported—Cost of Production

All the magnesite produced so far has been exported. Official statistics begin with the second half of 1913, when 2000 tons were shipped. Figures for the following years were—300 tons in 1914, 5300 in 1915, 6360 in 1916, 1700 in 1917, none in 1918 or 1919, 2000 in 1920, and 2400 in 1921. All these shipments were sent to the United States except the 1920, which went to Great Britain.

The original operator of the quarries sold magnesite before the European war for $7 per ton in New York, with freight at $2.25 from the port of Manzanillo, and made a small profit. The present cost of production and of placing a long ton of uncalcined magnesite on board a steamer at Manzanillo is about $5. Labor is cheap at the quarries and is fairly efficient when judged by West Indian standards. There is an abundant supply on the island—40,000 or 50,000 population and almost no industries.

A Quality Product—Good Transportation

The magsesite is white, uncrystalline and dense in texture, and quite free from impurities. It is stated to be especially suitable for all uses in which quality is essential. Chemically pure magnesite as found in nature contains 47.5% magnesium oxide and 52.5% carbon dioxide gas. Analyses of cargoes of 1000 tons or more shipped give about 95% magnesium carbonate and about 3% silica. Some lots shipped to the United States have given as high as 45.72% magnesium oxide, which makes it 96% pure.

Transportation is easy and not expensive, the deposits being not far from a good harbor. The company owns a railway line from the quarries to the port, capable of handling a monthly tonnage of 2000 tons. The port offers a sheltered harbor where large steamers can anchor with safety close to shore and load in all seasons.

Calcining Plant Contemplated

The operating company now contemplates having a calcining plant on the island. Magnesite loses about one-half its weight when calcined or burned, so that a local plant would mean a large saving in freight. The process changes it into magnesium oxide, a form in which it has many of its principal commercial uses, and furnishes gas as a by-product. There is no local market for this gas, but it has a sale in the United States.

Favorable reports have been made concerning other magnesite properties on the island. A leading authority, however, has stated that the only property which can be worked commercially is La Loma de Guerra. The Puerto Viejo was abandoned as having not enough magnesite in sight, and a deposit near the east end of the island proved to have too much silica, as well as presenting difficulties in transportation. All the deposits are near the north coast of the island.

Atomic Disintegration Applied to Find Relative Rock Age

PROF. ALFRED C. LANE, professor of geology, Tufts College, Mass., read a very interesting paper at the annual meeting of the Canadian Institute of Mining and Metallurgy held at Ottawa, Canada. He related in a way that could be easily understood by laymen, the difficulties that geologists encountered in classifying the different rocks and placing them in their correct position in the geological table and period. The geologist of the present day, he said, is applying analytical methods to solve the problems. By assuming the greater proportion of lead to have come from uranium as a result of atomic disintegration of the past, which is still going on, some kind of conclusion as to the relative ages of the rocks, which is more definite than that found from work done in the past, through study of fossils, etc., will no doubt be achieved. This, rather than the actual age in years, is the really important thing from the view of the student of mineral deposits.

The Albany Crushed Stone Company's Operation

THE EDITOR—The Albany Crushed Stone Co. plant was expected to cost $285,000 instead of $200,000 as mentioned in your article in the October 31 issue of ROCK PRODUCTS. It is designed to produce 3000 tons per day instead of 4000.

I think your figure of $100,000 in developing the quarry face is quite some too high, and I do not think anywhere near that amount additional will be necessary to fully develop the face.

We have no steam shovel (stripping) and no stripping is necessary, as there is no dirt on top of the ledge.

J. HARRIS LOUCKS,
President, Albany Crushed Stone Co.
Albany, N. Y.

Hints and Helps for Superintendents

Keeping a Gravel Bank from Caving

WHERE high banks of sand and gravel banks are being worked there is always danger from caving. Undercutting a bank may bring down a slide that will bury a steam shovel in a dry operation or seriously injure a dredge in a dredging operation. Slides of this kind, caused by undercutting and caving, have more than once caught men in their path and buried them.

The way to avoid such a danger is to cut back the top of the bank so that it stands nearly at the angle of repose and the easiest way to do this is with a stream of water. Not much water is required as the gravel is ready to slide as soon as the water loosens it a little.

In dredging operations it is a common practice to mount a pressure pump and a movable nozzle on a boat and sluice away the top of the bank. ROCK PRODUCTS has published a number of descriptions of this method. Sluicing may also be employed in dry land operations and it is employed in some of the plants on the Pacific Coast. All that is necessary is a supply of water and drainage at the bottom of the bank so that the water cannot accumulate there.

A pipe is brought to the edge of the bank and a stream of water allowed to flow down the face. This cuts back the top of the bank

The sluicing water is led to the top of the bank in a pipe and allowed to flow down over the face. It soon eats a channel as a rill of rainwater would. The bank material on the sides slips into the rill and the bank is thus cut back for a considerable distance. As soon as a slope is established in one place the pipe is moved to another and the process is repeated.

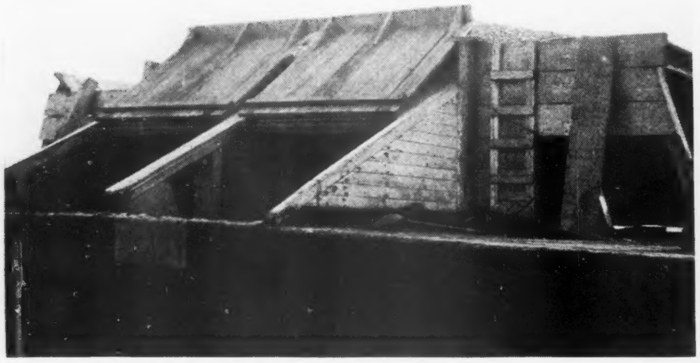
This work is kept ahead of the steam shovel or whatever machine or method is used to excavate the gravel. If it is a steam shovel the method works well for on arriving at that part which has been "rilled" the shovel finds a lot of loose, caved material ready to be loaded into cars before it attacks the bank itself. And as the bank is at or near the angle of repose all danger of caving is avoided.

This method is employed at the plant of the Heney Gravel Co., Seattle, Wash., where the picture was taken.

Method of Unloading a Gravel Barge

THE Pioneer Sand and Gravel Co. of Seattle, Wash., has an unusual method of unloading gravel barges at use at one of its yards in Seattle. All the gravel brought into Seattle comes by barges and at most of the yards the barges are unloaded by a stiff-leg derrick and clamshell bucket. This method is somewhat faster than the bucket and it has the advantage of allowing a better distribution of the gravel to bins.

The barges that unload at this plant are especially built for the work. They are 110 ft. long and 54 ft. wide and 11 ft. deep. They draw 8 ft. when loaded. They are of the flush deck type and below the deck is a double passageway running the full length of the barge. There are gates above these passageways so that a car can be loaded from above.



Left—Front view of barge, showing openings out of which the cars come. Right—Rear of barge. The hoist house and inclined tracks may be seen above the cabin

In the bottom of these passageways tracks are laid. These tracks come up an incline and out of openings in the front of the barge. When the barge is being towed these openings are closed by doors that are tight enough to prevent water entering in any serious amount, even when waves break over the doors.

At the dock the barge is held in place as a car ferry is held. A bridge with sections of track is let down to connect with the tracks which come up from the bottom of the barge and locked in place. This section

Car on the bridge between barge and incline

is curved so as to have an easy grade from the tracks on the dock to those on the barge.

Two cars are used in unloading and they are run in balance so that one is loading while the other is discharging. They are moved by a double drum hoist of local make. The car in the barge is loaded from the gates in the passageway, care being taken to draw from different parts of the barge so as to preserve the "trim." This automatically causes the car to spread the load along the bin.

In taking the pictures to illustrate this a place could not be found from which a picture to illustrate the whole operation could be taken. A barge which had just been unloaded shows the openings to the passageways with the open doors and the rear view shows the tracks and the hoist house over the bins. This method of unloading barges was worked out by S. J. Nerdsum, who has charge of the delivery yard of the Pioneer Company at which it is used.

Furnishing Water to Boilers in Cold Weather

By SUTTON VAN PELT
Superintendent, L. E. Myers Co., Monticello, Ind.

CONSIDERABLE difficulty is experienced at times in winter construction work in furnishing feed water to steam shovels and other construction equipment. Particularly is this the case in those climates where temperatures as low as 30 deg. F. below zero are frequently registered during the winter months. Some time ago I was connected with the construction of the West Neebish channel in the St. Mary's river in Michigan, and the fashion in which boiler water was fed to the steam shovels was simple and effective.

There were four shovels and some other boilers which had to be supplied and the problem was to provide boiler water at all times regardless of temperature, which during the months of January and February seldom rose above the freezing point.

The water supply plant consisted of one 6000-gal. wood-stave tank, one 35-hp. boiler and two reciprocating pumps—one a low-service and one a general service pump. Water was supplied to the tank by a pump used for pumping from the sumps. Live steam from the boiler and exhaust steam from the pumps was used to heat the water in cold weather.

Feed water was pumped to the various boilers through 2-in. lines which lay uncovered on the ground. The extreme length of these lines was about 2500 ft. in one direction and about 5000 ft. in the other, which, together with feeder lines, amounted to 12,800 ft. of pipe. Lines were laid with as few turns as possible and few valves so that water always circulated through all branches of the line whenever running. It was never allowed to remain standing in dead ends. During freezing weather, hot water was turned into the lines and kept constantly flowing until the boilers were supplied. Compressed air was then turned into the lines to blow out remaining water in order to leave the pipes practically dry. Ice did not accumulate to any appreciable extent and what small amounts did were melted by the next flow of hot water.

The lines were also piped to receive live steam, but it was never found necessary to use it. The method worked so well that only 2¼ hours per shovel per winter were lost on account of frozen pipe lines. In two seasons' time four shovels lost all told 50 hours of time, due to water supply troubles. Sixty per cent of this loss was from pumps, 25% through freezing and 15% through pipe lines.—*Engineering News-Record.*

Replacing Roll Shells

A SIMPLE and rapid method for replacing roll shells is in use at the crushing plant of the Miami Copper Co., Miami, Ariz. The rolls are 78 in. in diameter by 24-in. face. They are held in place by the usual tapered fixed and removable centers held together by through bolts. In replacing roll shells, the old shells are first cut with an acetylene torch and removed. The new roll shell is placed on the fixed center, the movable center is put into place, and both centers are bolted up tight. Before heating, when tight, the centers overlap the sides of the roll shell 1 in. on each side. The roll is then placed upon two steel jacks, which support it in a vertical position, leaving sufficient space beneath the shell. A ¾-in. pipe is looped around the roll shell and held in place by a rope clamp which binds the free end of the pipe to the pipe which extends to a coil and thence to a gasoline pressure tank. The encircling portion of the pipe is pierced with small holes at intervals and is supported so as to be equidistant from the center plane of the roll shell at all points. The coil is heated by a small wood fire and the gas as it issues from the holes is ignited. This affords a number of heating points on the outer surface of the roll shell. The shell is heated only to a temperature at which it "fries." When the shell has been sufficiently heated the gasoline supply is shut off, the encircling pipe is thrown aside, and both centers are driven flush with the edge of the shell by a ram suspended from a wire rope. The bolts are tightened and the roll is ready to be replaced. Roll shells last about 30 days. About an hour is required for heating and less than half an hour for finishing the job.—*Engineering Mining Journal-Press.*

Heating Aggregate in Winter

DURING the past winter the Atlas Sand & Gravel Co., of Indianapolis had to keep two large concrete jobs going in the dead of winter. From Christmas until the middle of February regular deliveries of sand and gravel were made and the work went on even when the thermometer registered sub-zero temperaturse.

The photograph shows how a heating system was installed at comparatively small expense and in a short time. The service bins from which the trucks were loaded are

Salamanders placed in the spaces between bins prevented freezing

of steel with hopper bottoms. Between the hoppers are open spaces which were closed with tight boarding. Bottoms of plank were put in and covered with two or three inches of sand.

Ordinary salamanders, burning coke, were put in these spaces and these kept the hoppers very hot. The heat and steam rising through the sand and gravel heated the rest of the material in the bin.

This system is probably not so efficient in the consumption of fuel as the usual method of putting steam pipes through the bin. At the same time it was more than justified by the short time and little trouble that was required for installation and its simplicity.

American Society of Testing Materials Discusses Cement and Gypsum

A NUMBER of the committees of the American Society of Testing Materials met in Cleveland, October 27, 28 and 29, and discussed progress in the various investigations which these committees are making. Two of these committees considered rock products, Committee C-1, on cement, and Committee C-11 on gypsum. The work of Committee C-1 is especially interesting as it holds a possibility that the present methods of testing portland cement may be altogether modified.

The following synopses of these committees' work has been furnished by the society:

At the meeting of Committee C-1 on cement held October 29, in conjunction with the group meetings of A. S. T. M. committees, three matters of especial interest were discussed.

The first relates to an intensive study of compression tests of cement that have been made by Sub-Committee VII on strength, under the chairmanship of P. H. Bates, chemist, U. S. Bureau of Standards, Washington, D. C. These tests, which, it is estimated, have cost upwards of $10,000, were designed to furnish more information in regard to the following five factors:

1. A satisfactory type of mortar compression test piece;
2. The effect of different percentages of mixing water in producing more uniform strength in the usual types of test specimen;
3. The relation of the strength developed by these compression test pieces to the tensile briquettes, both neat and 1:3 standard sand mortar;
4. The strength developed by both the compression and tensile test specimens at 72 hours; and
5. The strength developed by these at 72 hours by accelerated aging.

The entire investigation pointed towards either the modification or confirming of the present A. S. T. M. tentative specifications and tests for compressive strength of portland cement mortars (C 9-16 T), and also possibly to furnish data which might assist in devising strength tests which may be completed in less time than the present 7 and 28-day tests. In the past few months the data have been critically analyzed under the direction of Mr. Bates and at the Cleveland meeting Mr. Bates presented the information with a discussion and the statement that Sub-Committee VII will now begin an intensive study of the findings.

In the discussion of Mr. Bates' report it was evident that the committee is alive to the importance of certain discrepancies that have been noted in these and other series of collaborative tests, as for example, in the series of tests under the auspices of the U. S. Bureau of Public Roads, reported to the committee last spring.

The "Manual on Cement Testing" that was offered to the society at its annual meeting in June and accepted for publication, was designed by the committee as a step towards more accurately defining the methods of testing cement. The manual emphasizes those factors which may affect the results of tests and calls attention to less apparent influences which are important but are sometimes overlooked. The manual has been well received. The first edition of 4000 copies has been completely exhausted and a second edition of 5000 copies is being printed.

The collaborative work reported by Sub-Committee VII constitutes a further step to determine what changes or refinements are necessary in methods of testing cement to bring about greater concordance of test results. Certain further tests are being outlined by Committee C-1 having in view this general purpose. The first of these is a study of tests of neat cement mixed to a very wet consistency. The immediate objects of this series of tests are two-fold, first, to eliminate variations that are incident to differences in manipulation of test specimens by cement testers and, second, to obtain, if possible, a test which will bear a more definite relation to tests of concrete.

The second matter of interest is a report of progress that was made at the meeting by Sub-Committee III on fineness, on tests that are being made to determine what changes are required in order properly to define the present standard Ottawa sand in terms of the new sieve series proposed by Committee E-1 on methods of testing.

The third matter of interest discussed at the meeting related to the status of the society's standard specificaions and tests for portland cement (C 9-21) as an American standard, approved as such by the American Engineering Standards Committee. In view of the fact that revisions are being considered in both the specifications and methods of tests it is the desire of the society, as sponsor for the specifications, to have Committee C-1 on cement, with such additions in personnel as may be required, approved by the A. E. S. C. as a sponsor committee, to the end that revisions in these specifications when adopted by the society, may in regular course be approved by the Standards Committee. Committee C-1 discussed this matter at some length and is prepared to make suitable recommendations to the Executive Committee of the society.

The committee, through the Bureau of Mines, is still at work on investigations dealing with the possible use of gypsum-anhydrite mixtures in the manufacture of portland cement for the purpose of retarding the time of set. At the meeting of the committe, held in Cleveland, October 27-28, at which the vice-chairman, F. A. Wilder, president, Southern Gypsum Co., Inc., North Holston, Va., presided, a report by Ernest Berger of the Bureau of Mines, on the use of calcium-sulfate retarders for portland cement, and a treatise entitled "The Hydration of Anhydrite," by Miss Marie Farnsworth.

In the interests of the consuming public, the committee prepared tentative specifications for:

Molding and casting gypsum plasters, as well as dental, orthopedic and pottery plasters made from calcined gypsum.

The increasing demand for information regarding the use of reinforced gypsum for structural purposes, such as fireproof floors and roofs, has led the committee into research work and tests for the purpose of developing the following:

Check test methods for field use.

The determination of unit and ultimate working stresses for compositions of gypsum and various percentages of aggregate.

The possible adoption of specifications and recommended practice regarding structural gypsum in many of its accepted forms.

The development of specifications to govern the manner of selecting and preparing for use, test specimens from construction.

In the foregoing, assistance is being rendered by the testing laboratories of Columbia University and the Bureau of Standards.

The Bureau of Standards submitted to the committee for its information data regarding:

The elasticity of gypsum plasters of various mixtures;

The sand carrying capacity of gypsum plasters;

The modulus of elasticity of gypsum and aggregates.

At the next meeting, which will likely be held in March, 1926, at Washington, D. C., specifications for structural gypsum products will be prepared in tentative form.

As of late, these standards are as follows:

Gypsum Plasters (C 28-21).

Methods of Testing Gypsum and Gypsum Products (C 26-23).

Gypsum Partition Tile or Block (C 52-25).

Gypsum (C 22-25).

Calcined Gypsum (C 23-22).

Gypsum Plastering Sand (C 35-25).

Gypsum Wall Board (C 36-25).

Gypsum Plaster Board (C 37-25).

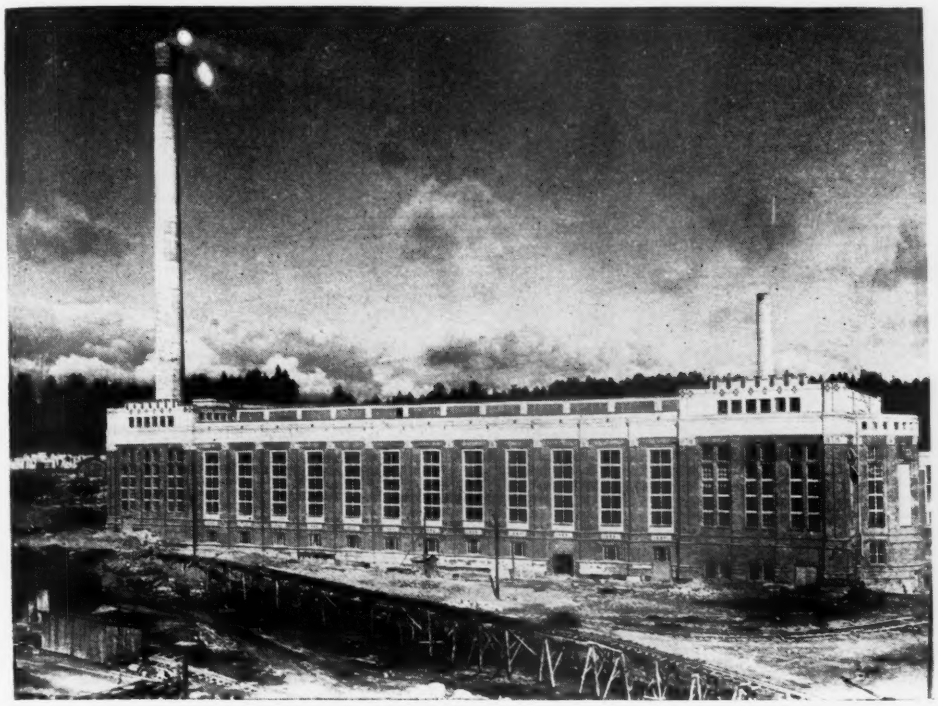
The committee felt that the standards set by the American Society for Testing Materials represented, to the consuming public, an assurance of quality not obtainable elsewhere. It was the opinion of the committee that the manufacturers should use a statement on materials marketed as follows:

"The contents of this package, manufactured by the .... Company, comply with the requirements of the Standard Specifications of the American Society for Testing Materials for this gypsum product."

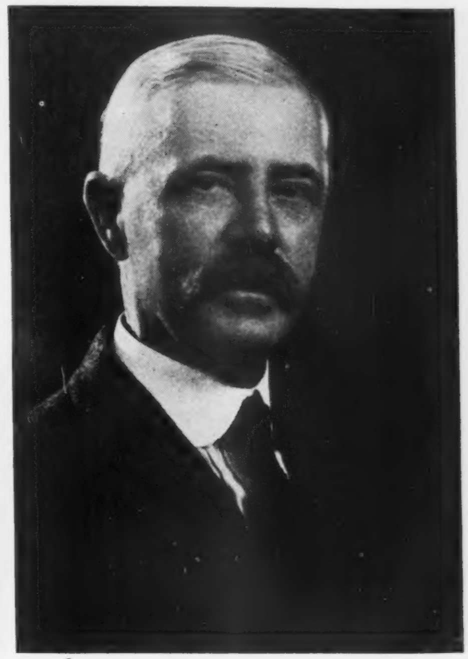
Some Cement Plants in Northern Europe

Views of Typical Operations from Finland to Hungary

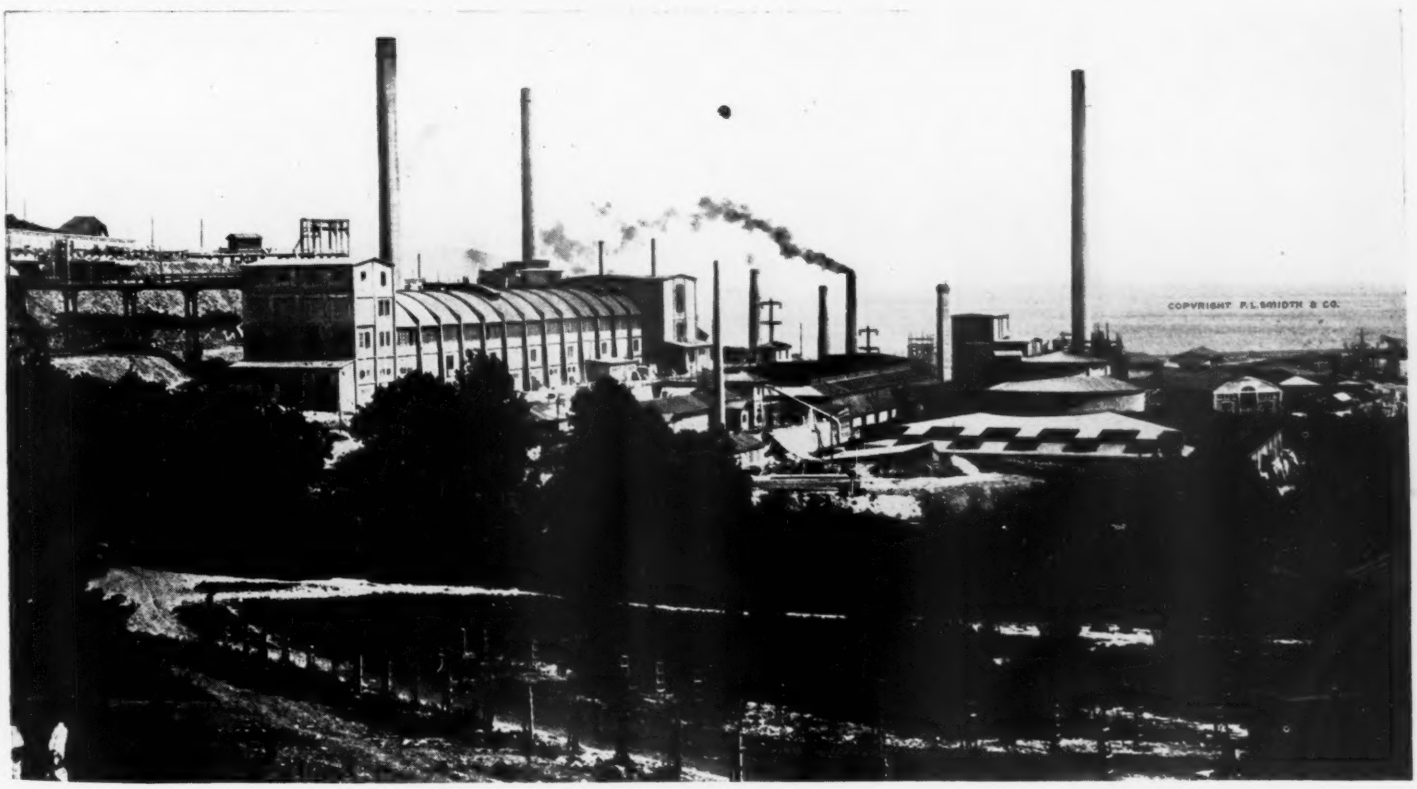
JOHN E. MEEHAN, veteran erection superintendent of F. L. Smidth and Co., cement plant engineers and builders, New York City, has recently returned from an extensive European trip. Seemingly the deepest impression made on Mr. Meehan's mind was the almost universal accuracy, carefulness, and stability in plant design and the intelligence and cleanliness of plant operation. In the matter of detail



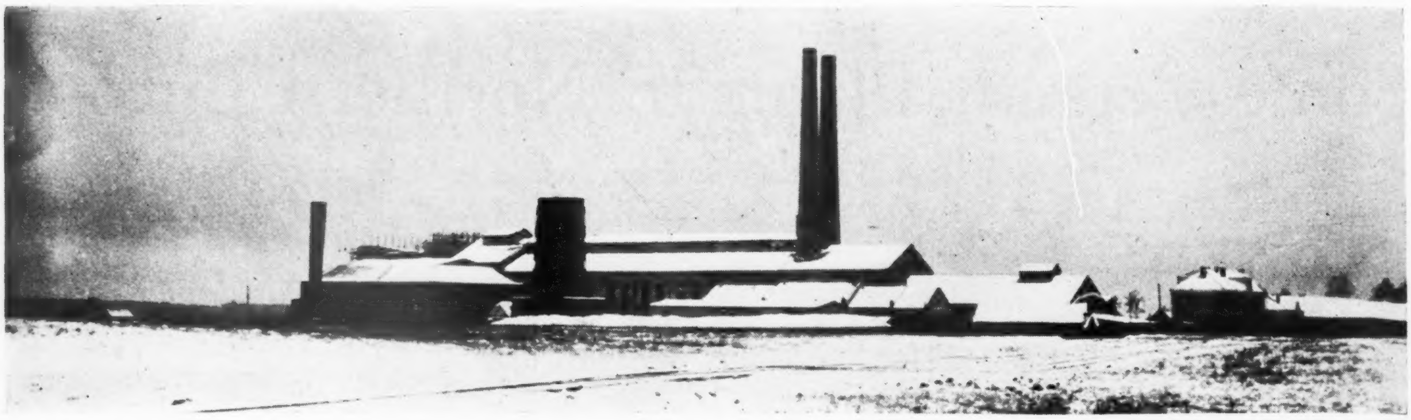
Pargas cement works, Pargas, Finland; wet process; hard raw materials



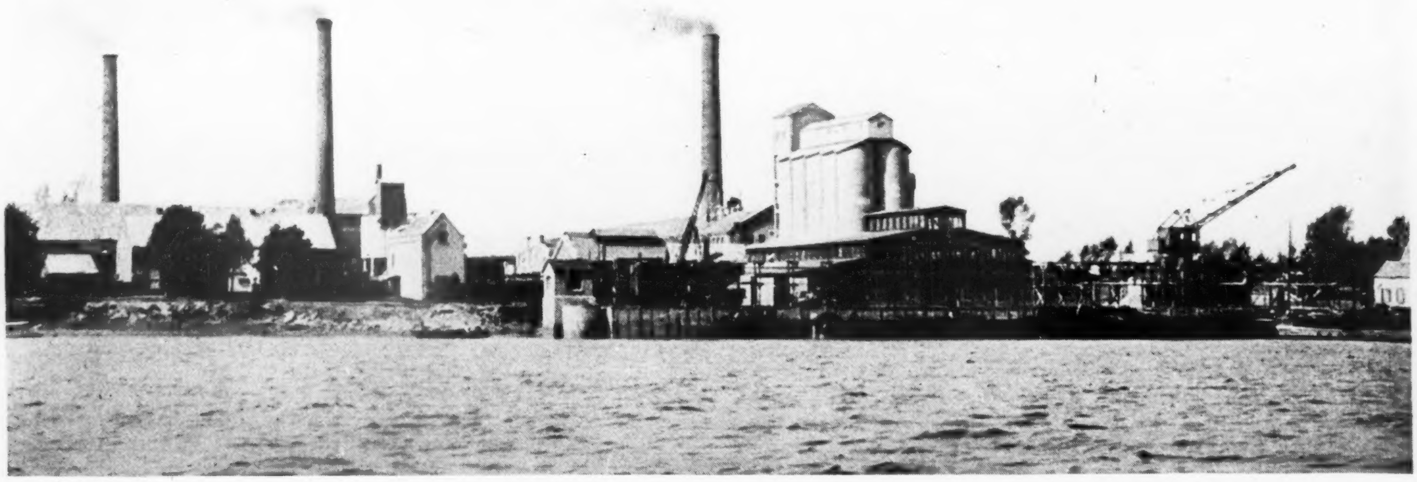
John E. Meehan, to whom we are indebted for the views herewith



Cement Manufacturing Co. on the Black Sea, Noworossiisk, Russia; wet process; hard raw materials; annual capacity of new works 1,000,000 bbl.

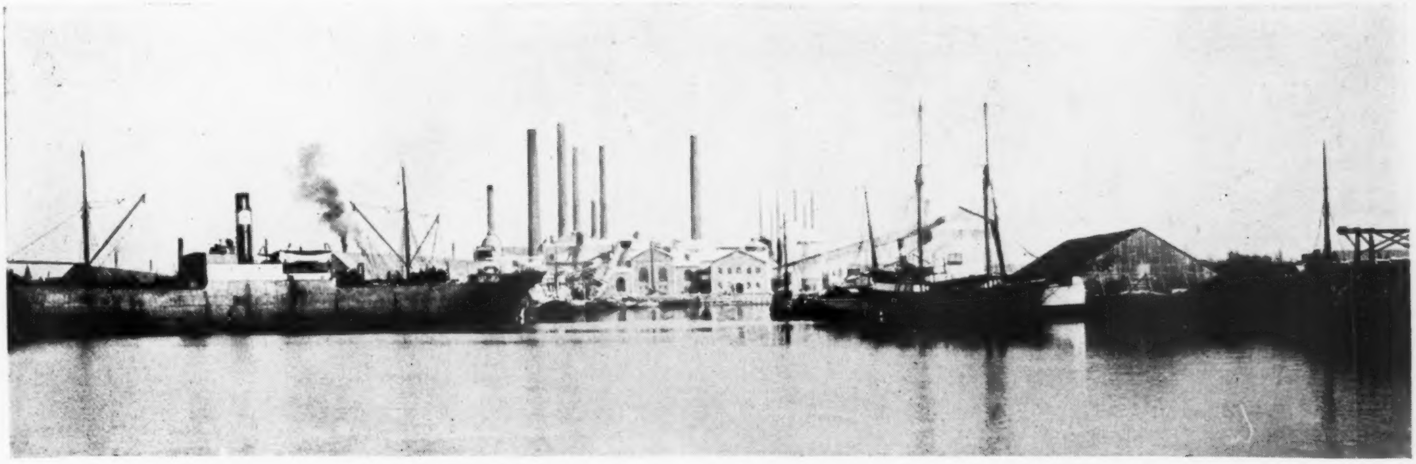


Fabryka Portland Cementu "Firley," Reiovice, Poland; general view of the works—annual capacity 600,000 bbl.

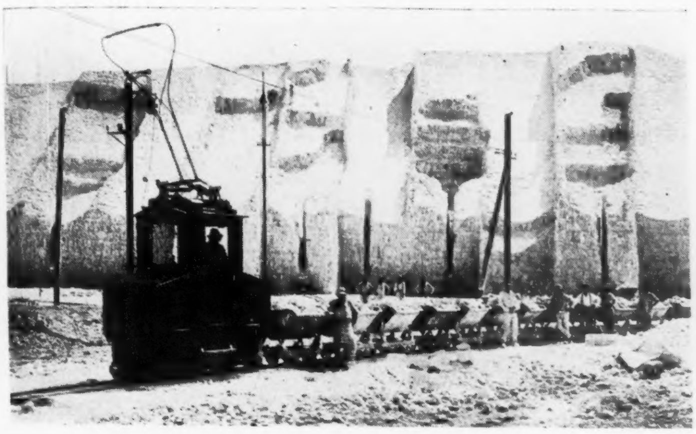


Cannon Brand Artificial Portland Cement Works Co., Burght-lez-Anvers, Belgium, wet process, soft raw materials, annual capacity 330,000 bbl.

Hungarian General Colliery and Mining Co., Inc., Felsogalla, Hungary; wet process, hard raw materials, annual capacity 1,500,000 bbl.



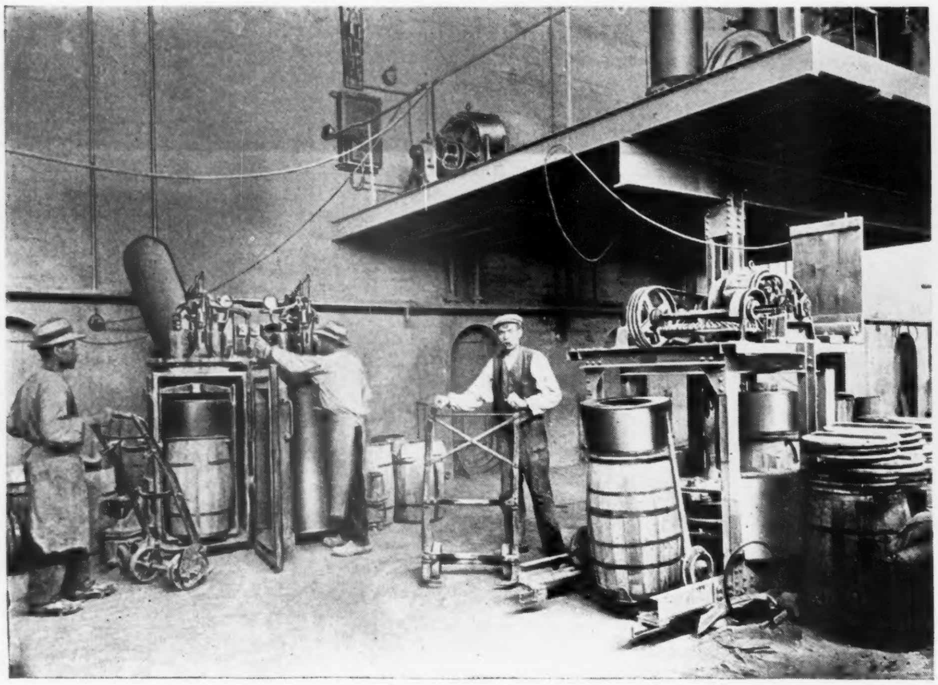
Skanska Cement Aktiebolaget, works at Linhamm, Sweden; w t process, hard raw materials; annual capacity 900,000 bbl.



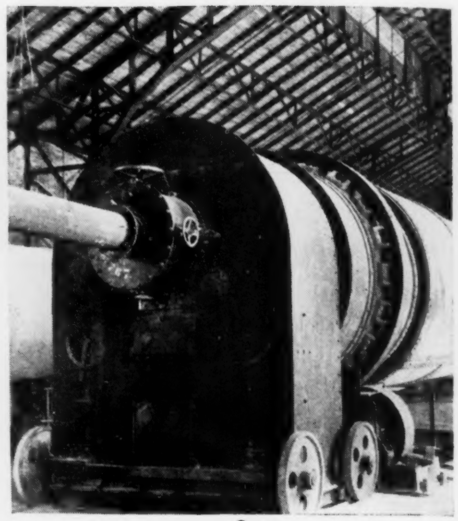
Aalborg Portland Cement Works, Aalborg, Denmark

Chalk quarry of Aalborg Portland Cement Works

Aalborg Portland Cement Works, general view; wet process, soft raw materials, annual capacity 1,500,000 bbl.

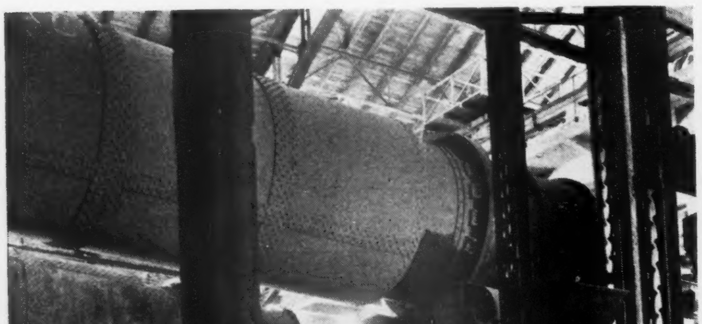


Aalborg Portland Cement Works, packing cement in barrels with "Exilors," a patented automatic device



Fabryka Portland Cementu "Firley" Reiovice, Poland; wet process; soft raw material; 207-ft. kiln

The Aalborg Portland Cement Works, illustrated in the view to the left and on the preceding page is the place where many devices and processes in the cement industry have been developed



Fabryka Portland Cementu "Firley," Reiovice, Poland; kiln discharge end and clinker cooler

Fabryka Portland Cementu "Firley," Reiovice, Poland; coal feed to rotary kiln shown above

Hungarian General Colliery and Mining Co., Felsogalla, Hungary; two rotary kilns 230 ft. long

Chain bucket carrier, Hungarian General Colliery and Mining Co.

Feed tables of kominuters, Hungarian General Colliery and Mining Co.'s portland cement plant

there were so many admirable things that to write a "story" within the limits of a magazine article would involve discrimination which might not be justified by the observations of one individual. The illustrations would appear sufficient to tell the story. At least they show that the United States has no monopoly of good plants. The lesson is that how the other fellow does it has a considerable value.

The plants illustrated were all engineered and equipped by F. L. Smidth and Co. The Aalborg Portland Cement Works at Aalborg, on the Limfjord, Denmark, built in 1890, illustrated in these pages, is the second portland cement plant built by the firm, which from the start has had a large financial interest in it. Here much of the experimenting and development in cement-mill machinery has taken place.

Constitution of Portland Cement Clinker

INVESTIGATION made of the character of the change in constitution of various mixtures of CaO, SiO_2 and Al_2O_3 in the burning of a raw portland cement. First formation of alpha 2CaO, SiO_2 and consequent change to beta and gamma forms under influence of temperature and the determination of the hydraulic activity of these compounds. Final change at 1800° C to 8 CaO, $2SiO_2$, Al_2O_3.—*Zement,* 1925 (419-422).

Effects of Gases on Cement Surfaces

SANDING action on the surface of a clay cement made up with water was observed under the influence of ordinary air, air free of CO_2, and in atmospheres of oxygen and of CO_2. Sanding occurred greatest in CO_2, slight in air free of CO_2 in which the cement set hard and none in atmosphere of O with resulting absolutely hard cement. For practical purposes the sanding action can be checked by wetting of the surface after an initial set of six hours.—*Zement,* 1925 (597-8).

Fluorine Compounds on Concrete

CONCRETE surfaces sprayed with aqueous solutions of fluorine compounds (lithurine and prolapine) such as 3 SiF_4 .2 AlF_3 and 3 $MgSiF_6$ show considerable hardening and weathering properties and greater resistance to heat and cold in addition to filling up of surface. Proof that there is formed new compounds with the CaO in concrete. Further testing with dilute acids shows no decomposition or effervescence of CO_2. Permits the use of such treated material in structures where resistance to moisture, air heavy in CO_2 or SO_2 or organic acids is needed.—*Tonindustrie-Zeitung,* 1925, (813-14).

Possibilities for Much Greater Use of Lime in Treatment of Locomotive Boiler Water*

Lime-Soda the "Standard and Complete Method" of Treatment

By R. C. Bardwell
Superintendent Water Supply, Chesapeake and Ohio, Richmond, Va.

THE quality of water supply is closely associated with the operating efficiency of a railroad, and its result is of vital interest to the management, as well as to all departments. Of the 350,000,000,000 gallons of water which are now being used annually for steam consumption on American railroads, it is estimated that 50,000,000,000, or about 15%, is receiving treatment in some form. At a general average cost of 4 cents per 1000 gallons for treatment, the yearly operation expense involved is in the neighborhood of $2,500,000. There are approximately 1200 water stations, out of a total of 16,000, where chemicals are added, and the total investment in softening plants, including the inexpensive as well as the elaborate types, is at least $10,000,000. It is estimated that these plants are removing 100,000,000 lb. of scale-forming solids annually, which, if allowed to enter the locomotive boilers, would represent an additional expense in locomotive operation and maintenance of approximately $13,000,000.

The Standard Method

The standard and complete method of complete water softening consists of the addition of lime and soda ash to the water in predetermined amounts at wayside settling tanks. Its object is not only to soften the water but also to remove the precipitated sludge with other mud or suspended matter, so as to deliver the water to the boilers not only soft, but clear. Common lime and soda ash are used for the reason that they are the lowest priced chemicals which can be obtained to do the work efficiently and economically. The types of plants vary not only with the patented proportioning equipment on the market, but also with the designs prepared to handle the local and individual conditions best. With proper attention and supervision, experience has shown that decidedly satisfactory results can be obtained in the way of scale and pitting elimination and that the economies effected usually far exceed the estimate.

Two Types of Plants

There are two general types of lime and soda ash plants, called the intermittent, and the continuous. The intermittent type consists of one or more tanks which are filled with water, the chemicals then being added and the mixture stirred, after which, following a sedimentation period, the water is clear and ready for use. By manipulation of valves, the tanks can be used alternately for delivery to locomotives.

Continuous Type of Plant

Plants of the continuous type consist of large tanks, usually of steel, with inside tubes of sufficient size to retain the water during the mixing period of from 30 to 45 minutes. The water and chemicals are mixed in these tubes in continuous proportion, flowing from the mixing tube to the bottom of the sedimentation tank from which they rise to a predetermined point before the clear water is drawn off for service. The specific gravity of the precipitated sudge is sufficiently greater than the water to permit complete clarification in five hours if the vertical velocity of the settling water does not exceed 8 ft. per hour. If clarification troubles are experienced, filters are sometimes provided which usually consist of matted excelsior at the top of the sedimentation tank, although there are a number of plants in service with rapid sand filters or pressure filters, either of the latter requiring transfer pumps which are unnecessary in the former case.

Offers Marked Savings

It seems needless to say that any of the various impurities in water will cause trouble contingent upon the amount and kind. Removal of such impurities is certain to show improved results, dependent upon the amount removed. The American Railway Engineering Association presented figures in 1914 to show that the cost of each pound of incrusting matter permitted to enter the locomotive boiler was 7 cents, considering only the effect on fuel consumption, boiler and roundhouse repairs and engine time. This figure, transposed to present day prices, is 13 cents. Study by a special committee of the American Railway Engineering Association for the past four years has found that the statistics which have been gathered indicate that this figure is decidedly conservative. There is no question but that, with proper treatment of the water, scale and pitting conditions with their incident boiler maintenance expense, can be very largely eliminated and that the fuel consumption in clean and dry boilers is much less than with leaky or badly scaled power. In addition, the large intangible benefits, such as elimination of engine failures on the road and the reduction in delays to traffic and train movements, usually far outweigh the tangible savings in fuel consumption and boiler repairs.

*Abstract of a paper read at October convention of the American Railway Bridge and Building Association, Buffalo, N. Y.

New Lime Association Bulletin on Water Softening

THE National Lime Association, Washington, D. C., has prepared a bulletin of 48 pages on water softening. It contains some extremely interesting and valuable information, easily read and well illustrated. The treatment of the subject is non-technical as far as possible and the bulletin will be of interest and value to all those who have anything to do with water treatment.

There are four main chapters in this new publication, each relating to a particular phase of water softening or treatment. These chapters have been prepared by authorities and carry a valuable message. The first, "Advantages of the Use of Lime in Water Treatment," is by C. P. Hoover of Columbus, Ohio. The second discusses "The Cost of Impurities in Locomotive Water Supply and Value of Water Treatment," and is from the report of the Water Service Committee of the American Railway Engineering Association. The third chapter, "Raw Water Ice," presents much valuable information in unusually interesting style. C. Arthur Brown prepared the last chapter, "Some Variants from Accepted Formulae in Water Flows," and has clearly explained and simplified a number of the mathematical formulae commonly used by water works superintendents and operators.

This bulletin will be sent free upon request to the National Lime Association, 918 G. street, N. W., Washington, D. C., or 844 Rush street, Chicago, Ill., or any member company.

T. R. Barrows' Address to the Pacific Coast Association

Executive Secretary of the National Sand and Gravel Association Tells of the Progress of the Industry and the Work of the Organization

THE following address was delivered to the members of the Pacific Coast Sand and Gravel Association by T. R. Barrows, executive secretary of the National Sand and Gravel Association, in San Francisco, November 13. The occasion was the first annual meeting of the Pacific Coast Association, held in connection with the Western Road Show:

As the executive secretary of the National Sand and Gravel Association, I am here today at the courteous invitation of the committee which arranged the program for this meeting of sand, gravel and rock producers, and I wish to express my gratification for this opportunity of meeting the representatives of the industry which has filled such an essential role in the building of this empire west of the Rocky Mountains.

It is not my desire to tire you with platitudes about the value of organized effort in industry, for the benefits of organization are too well-known, its results are manifest in too many instances to need my voice as a champion.

Still, it is appropriate for me to refer in some measure to the things which led to the creation of the National Sand and Gravel Association more than ten years ago and to a few of the activities in which it has engaged for the benefit of the industry as a whole.

According to the constitution of the association, every action of the organization must be in keeping with the following objects:

First, to promote and extend the use of the products of the industry.

Second, to provide an organization for the cooperation of the members and the coordination of their efforts with those of other trade associations and with governmental agencies in the furtherance of all projects affecting the industry.

Third, to establish and maintain the highest standards of business practices, customs and usages among the members, and to protect the interests of the industry.

I am sure it is within the easy recollection of you gentlemen when the sand, gravel and rock industry was more or less a haphazard undertaking, without adequate recognition by the government or the states, by other trade organizations, or by the scientific bodies through which this Association is now doing an essential work for the industry.

Today, this industry, through its national association, is fully and officially recognized by all departments and bureaus of the Federal Government, by the American Society for Testing Materials, by the American Railway Association, and by the organizations of other responsible industries.

The established sand and gravel industry, as a result of the work of the National Sand and Gravel Association, is accorded more recognition, more consideration at this time than it has ever enjoyed before.

T. R. Barrows, Executive Secretary of the National Sand and Gravel Association

The views of the National Sand and Gravel Association, as the accredited representative of this industry, are given consideration on an equal plane with other major industries whose products are used in the vast construction program of this country.

Perhaps if a specific instance is cited of the every-day work of our association, you will secure an understanding of the resources which the organization provides for the industry in cases where individual action, by its own limitations, would be of no avail.

Some time ago government officials appointed a Federal Specifications Board, which was charged with the duty of preparing specifications for use by all branches of the government in the purchasing of commodities which it employs in Federal-aid road work and in all general construction work of the government.

The specifications relating to the use of sand and gravel were submitted to the Nation Association for criticism and suggestion before they were adopted by the board and, in this way, the association was enabled to insure that the provisions of the specifications were such that they would be to the advantage of the established sand and gravel industry.

It would have been impossible for the Federal Specifications Board to consult the wishes of every sand and gravel producer in the country in preparing specifications for the use of these materials. But the board could submit the specifications to the organization which represented these producers and which was authorized to speak for them in such matters.

Here we have illustrated forcibly the need of organized effort in order that the interests of all may be protected, for the board is assured that it will not issue ill-advised specifications for sand and gravel, and the men who are producers of those materials are safe in the knowledge that their organization has proceeded in such a manner that each of them has shared in a common benefit.

If I may be permitted to cite another instance of the value of cooperative effort, I should like to mention the recent proposal of carriers in western territory to increase all rates on sand, gravel and rock by 7½c per ton. Please bear in mind that the carriers themselves are joined together in compact organizations and that they, long ago, learned from bitter experience that their salvation, even their very existence, rested on organization and cooperation.

Proceeding instantly to utilize the resources of their organization, western producers of sand and gravel called upon the National Association to formulate a program for resisting the efforts of the carriers to place this additional and unreasonable charge on the transportation of their materials. Within a very short time, expert attorneys and commerce counsel were busily engaged in the preparation of data and evidence which would support the position of the producers that the proposal of the carriers should be rejected by the Interstate Commerce Commission, and the latter body has assigned a date when it will listen to the National Sand and Gravel Association, as the accredited representative of the industry in the west, in its presentation of the case of sand and gravel producers.

As a direct result of the National Sand

and Gravel Association, western producers of sand and gravel have been able to take prompt action to avoid a most serious danger; they have saved themselves the enormous expense which would have been involved if each individual producer attempted to fight the case on his own behalf, and they have been able to coordinate the interests of all in a single force which is assured of full recognition by the Interstate Commerce Commission. Indeed, it is apparent that individual producers, or even local groups of producers, could have proceeded only in the most limited manner and that they could not have presumed to speak for the industry as a whole.

The sand, gravel and rock industry, from its modest beginning some years ago, has advanced to the dignity of a major factor in the industrial life of the country. During 1924, the railroads of this country, according to the official reports of the Interstate Commerce Commission, derived a revenue of approximately $125,000,000 from the transportation of sand, gravel and rock, and bituminous coal is the only item of revenue freight traffic whose volume exceeds that of our materials.

The volume of sand, gravel and rock traffic is almost equal to the combined total of all agricultural products, and it exceeds the volume of lumber movement, and anthracite coal as well. From a revenue standpoint, sand, gravel and rock traffic contributes more than the combined total of cement, brick, artificial stone, lime, plaster, sewer pipe and drain tile.

This rapid advance to the standing of an essential industry has witnessed the investment of many millions of dollars in the production, proper preparation and marketing of sand and gravel. That investment, if it shall be safeguarded, must be reinforced by a central organization which can speak for the industry in questions of mutual importance and which can protect that industry when its interests are threatened.

A case in point is the representation of the National Association on the American Society for Testing Materials, the latter being the foremost organization of its kind in the country, whose judgment and conclusions are accepted as authoritative by the government, the states, counties and municipalities. The society frequently is called upon to approve specifications which involve the use of sand and gravel or which relate to the testing of these materials before they are used in public and private construction of all sorts.

When such questions are submitted to the society, they are referred to appropriate committees for investigation and report. On each of the committees whose work affects the established sand and gravel industry there is a representative of the National Sand and Gravel Association, who is there to protect the interests of the industry at large. Thus the different companies which are members of the National Association are enabled to exert their combined influence upon those recommendations of the American Society for Testing Materials which govern the use of sand and gravel.

As I believe you gentlemen already know, the National Sand and Gravel Association represents the established and responsible producers of sand and gravel and we number in our membership the largest producers of sand and gravel in this country, such as the Coast Rock and Gravel Company of San Francisco, the Union Rock Company of Los Angeles, the Greenville Gravel Company of Greenville, Ohio, the Chicago Gravel Company of Chicago, the Missouri Portland Cement Company of St. Louis, the Jahncke Service, Inc., of New Orleans, the Roquemore Gravel Company of Montgomery, Ala., the Ohio River Sand Company of Lousville, the Keystone Sand and Supply Company of Pittsburgh, the Van Sciver Corporation of Philadelphia, the Charles Warner Company of Delaware, and many other large companies whose individual production exceeds one million tons.

The National Sand and Gravel Association is an incorporated organization, absolutely free from all indebtedness. It is at this time more firmly established than ever before in its history, and all the resources derived through the support of its members are being used to extend the use of properly prepared sand and gravel.

In order to make perfectly clear the position of our executive committee, I should like to state that the association, as it is presently organized, is functioning satisfactorily for the active members and has no financial obligations of any sort. The officers of the association feel, however, that inasmuch as the principle is sound, the work of the organization can be made still more effective if every established and responsible sand and gravel producer takes an active interest in the organization which has already proven a valuable investment for those who have been members since its inception.

The newest addition to the work of the association is an engineering and research department, at the head of which is Stanton Walker, who is a recognized authority in the art of concrete and who has served for many years in the Structural Materials Research Laboratory of the Portland Cement Association.

This means a broadening of the engineering service which the association performs for its members, and Mr. Walker's department will interest itself in the development of facts concerning the production and marketing of the materials produced by member companies. This department will also identify itself with professional and technical societies having to do with the construction industry, as well as the maintenance of relationships with various government departments, state highway commissions and county and municipal engineers, with the purpose of placing in the hands of these agencies full information with respect to the economical value of properly prepared sand and gravel.

One of the most important activities of the National Association is a thing to which I have not as yet referred; and that is the personal, individual service which the association performs only for its member companies. This service covers a multitude of matters and it touches practically every phase of the operations of a sand and gravel plant. Time does not permit of a full enumeration of this personal service, but among the most important are car shortage complaints, income tax service, general traffic service, local advertising campaigns, satisfactory specifications, representation before all departments of the government in personal matters such as the Patent Office, Federal Land Office, Bureau of Standards, and others.

The records of the Washington office of the National Sand and Gravel Association, containing unsolicited expressions of commendation from members in every section of the United States, sustain the statement that the personal service rendered by the organization has been of definite, tangible and concrete value to the membership. This has meant that memberships in the organization are investments which have yielded satisfactory returns.

The time is at hand when the members of all industries, and the sand and gravel industry is no exception to the rule, must join together if they wish to avoid the economic disaster which is bound to come under a survival of the fittest policy. The sand and gravel industry in the Pacific Coast states will be called upon to contribute its share in the construction program which the steadily growing needs of this section will demand. It would be indeed unfortunate if the industry, under those circumstances, is not able to cooperate for its common good.

It is most gratifying to the officers of the National Sand and Gravel Association to observe the splendid interest which producers in this section of the country are showing in the newly-organized Pacific Coast Sand and Gravel Association. That association has been fortunate in securing the services of Mr. E. Earl Glass as general manager, who brings to the organization a wealth of experience in association matters and an equipment for aiding the industry in meeting the many problem which it faces.

Every industry of importance is organized in a body which speaks for that industry on questions which affect its interests. Indeed, industrial history reveals that stability and prosperity come to major industries only when such industries have perfected an organization and have presented a solid front in carrying on their daily activity all over the country.

The National Sand and Gravel Association belongs to the membership. Its value will be measured by the active support which it is accorded by those in the industry. Its possibilities are unlimited, its need is demonstrated, and its future is assured.

New Ideas and Methods in Pacific Coast and Southwestern States

Cement Plants Building and Old Ones Improved—A New Type of Lime Kiln and New Gypsum Block Machine—New Use for Burned Lime

By Edmund Shaw
Editor Rock Products

CONCRETE has long been a favorite building material on the Pacific Coast and a comparison of the increase in all kinds of construction with the increase in cement production tends to show that it is growing in favor. It is natural that this should be so as concrete employs local materials altogether and keeps the money spent for building at home. How much this means is illustrated by a story which was told me of the building of a big hotel in Seattle, one of the largest and finest hotels on the Pacific Coast. The money for it was raised locally and a famous New York architect was employed to make the plans. When these arrived it was found that they called for a steel frame structure with walls of hollow tile. The stockholders did some figuring and found that something between $300,000 and $400,000 would be spent with eastern manufacturers and in paying railroad freights and they asked that reinforced concrete be substituted. The architect objected to changing the plans and in the end a compromise was reached so that the lower floors were of steel frame and the upper floors of reinforced concrete in which everything, including the reinforcing steel, was of local production.

Rebuilding with Concrete

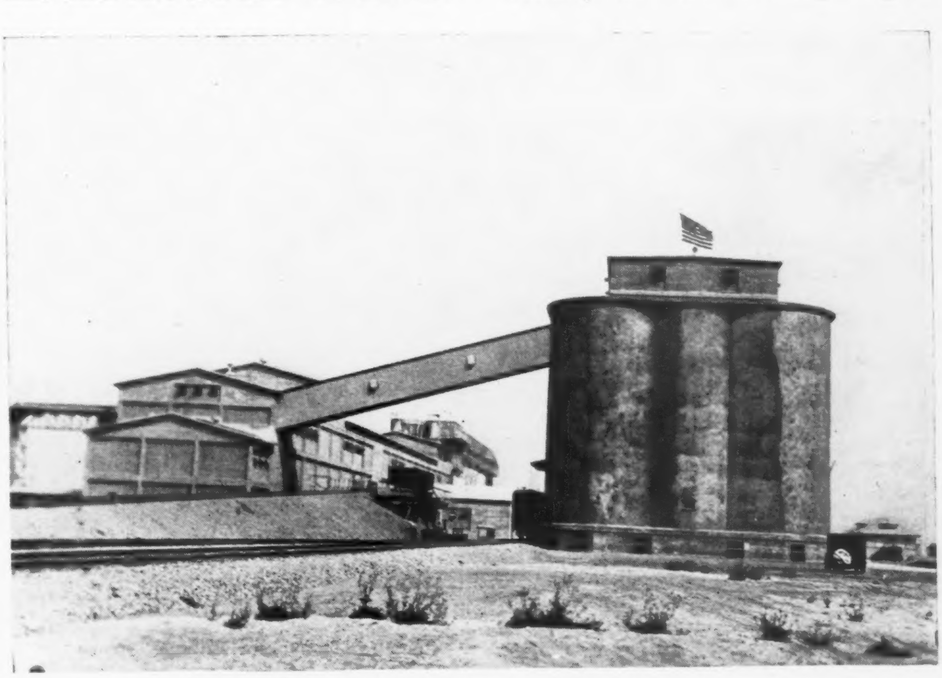
Two widely advertised examples have this year attested to the overwhelming popularity of concrete, the building of Longview, Wash., with its 360,000 yd. of concrete for 8000 inhabitants and the other the rebuilding of the burned district of Astoria, Ore. Every building but one has been or is being built of concrete in that district. And immense quantities of concrete are used in building the peculiar type of street necessitated by the fact that the street levels are 6 ft. above the ground in Astoria. These streets have what are called "Aston" walls of concrete on either side rising from the ground and sand is sluiced between them to bring up the grade. A concrete roadway is then laid on top of this sand.

Santa Barbara is being largely rebuilt of concrete and the "cement gun" is being used to a greater extent that it ever was before for patching and reinforcing damaged structures. It is a new idea to many of us that damaged concrete may be so easily and quickly repaired in this way. In some cases whole walls and columns are being replaced.

In and around San Francisco the cement plants are as busy as possible, but one hears little of the proposed plants whose plans for building were so much advertised a year ago. Even one which was supposed to be completely financed is delaying its actual building. The Calaveras Cement Co., however, is going steadily ahead with its construction and had reached the stage of pouring foundations when I was in the city. From information given me by the company, the plant will be ready next March. There will be two kilns 250 ft. long and 11 ft. 3 in. in diameter, the largest on the coast. Incidentally, this is the size of the kiln of the Trinity Portland Cement Co. at Ft. Worth, Texas, among the largest kilns which have been built. The Calaveras company is opening its quarry using Armstrong drills and Bucyrus shovels, one steam and one electrically driven. The plant will be served by an overhead crane and Fuller-Kinyon pumps will be used to transport the cement to the concrete storage silos. A production of 4000 tons a day is expected.

Cement from Oyster Shells and Mud

I visited the new plant of the Pacific Portland Cement, Consolidated, at Redwood City, near San Francisco, where cement is made from oyster shells and the mud which accompanies them as they are pumped from the bottom of the bay. Chemically there is little difference between these and more usual raw materials but there are some interesting details which will be given more fully in an article. The plant is a splendid one, about as fine an example of industrial building as could be imagined. Unusual care has to be taken to keep dust or fumes from polluting the air as the district is highly restricted and the gases from the kiln are first washed and then sent to a Cottrell precipitation plant, which has been installed quite recently.



Packing plant and silos of Pacific Portland Cement Consolidated

Probably the most interesting thing in the cement industry near San Francisco is which the Santa Cruz Portland Cement Co. is carrying on. The company does not feel that the experiments have reached a stage where it would be wise to publish details, but if the experiments are successful they may cause something of a revolution in the

cement industry according to those familiar with the work.

Plastic Cements

I heard of the plastic cements made near Los Angeles, at Seattle, Portland and San Francisco, and was told that there was a considerable demand for them, especially for making stucco, which is so much used on the better class of dwellings on the Pacific Coast. Beside being plastic they are waterproof and they have a high sand-carrying capacity. One of these, which is called "Plasticite," I did not have a chance to investigate, the other, the plastic waterproof cement of the Monolith Portland Cement Co., was explained to me by a representative of the company. It is a true portland cement having less than 0.5% insoluble matter and low in magnesia and sulphuric anhydride which brings it well within the A. S. T. M. specifications for portland cement. The grinding is very fine, 99% passing 100-mesh and 92.6% passing 200-mesh. The waterproofing qualities are due to the grinding of a light oil with the clinker. Apparently this cement is especially adapted for use in oil tanks, for the Pan-American Petroleum Co. has just built immense storage tanks of it, using 3,000,000 bbls. in their construction. The cement is expensive but apparently has qualities for which buyers are willing to pay when it is needed for special purposes.

The building of the big oil reservoir shown was interesting otherwise than because of the cement that was used. The job was carried on in three 8-hr. shifts so that the pouring never stopped from the time it was started until the last mixer full went into the forms. This necessitated thorough organization of all the details, especially the delivery of materials. The aggregate was all washed sand and crushed rock which was supplied by the Union Rock Co. of Los Angeles. As many as 40 carloads a day were required and all deliveries had to be absolutely on time. The reservoir is the largest oil reservoir ever built and it is one of the largest concrete jobs in the country.

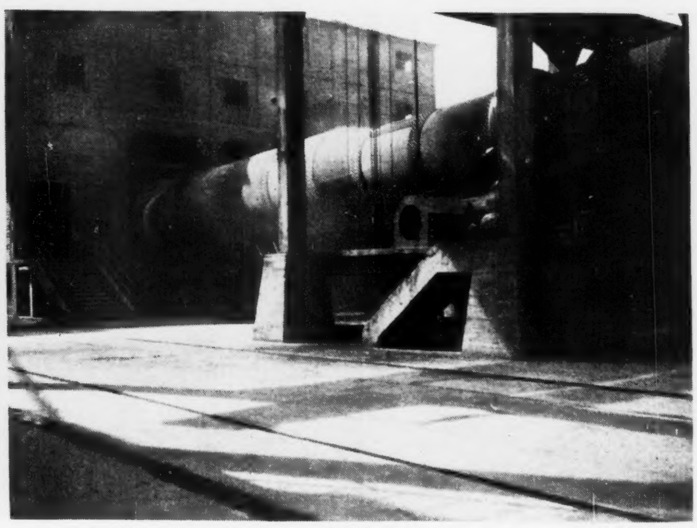
I heard nothing of new cement plants to be built in southern California but on reaching El Paso I was told that a new cement plant at Phoenix, Ariz., was beginning construction. It has been rumored for some time that a plant would be built there.

The most interesting thing I saw or heard of in Los Angeles was the new lime kiln which the Blue Diamond company is erecting. It will be ready about December

Southwestern Portland Cement Co.'s plant at El Paso

El Paso Building Materials Co.'s lime plant at El Paso

New German-made tube mill at the El Paso cement plant



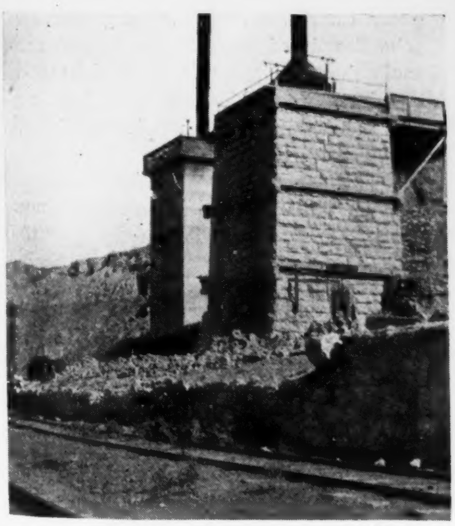
"Bottlenecking" the kilns at the El Paso cement plant increased their capacity

1, after which a complete account may be published. The kiln was designed and built by William Hill Barton, who has been around lime kilns ever since he was a boy, as his father owned and operated a lime plant at Ash Hill, Mo. Mr. Barton studied kilns both here and in Europe and the result of his study and experience is a kiln that will be operated as automatically as it is possible for a kiln to be. Every detail from charging the stone to hydrating the lime and pumping the putty to the agitating and aging vats of the Blue Diamond mixed mortar plant will be under the control of an operator who will be guided by pyrometers and indicators all through the work. The kiln is admittedly an experiment but the details have been so carefully worked out and the method is so logical in every way that it is difficult to see how it can be anything but a success.

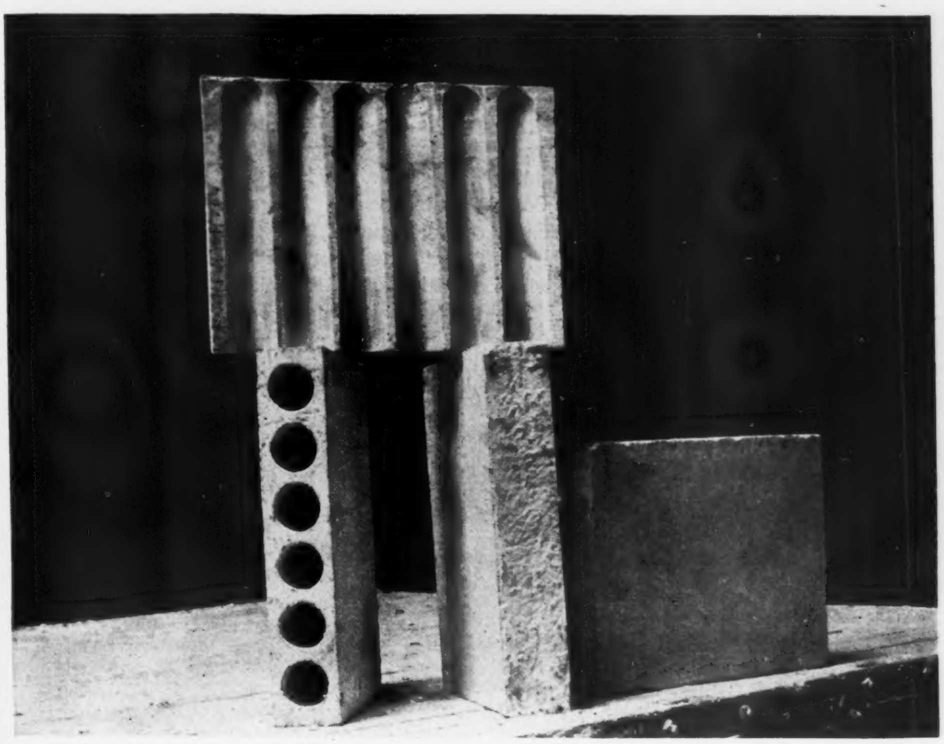
A great storage tank for oil built of plastic, waterproof cement

A. Courchesne, pioneer in various rock products industries

The Blue Diamond company has just gone into the gypsum block business and has acquired the machine developed by L. R. Coffin, who has been making blocks in Los Angeles for a number of years. The block is unique in that the core holes do not go all the way through, so that there is a solid web on one end. The cores are of glass and the method of withdrawing them and of getting the blocks out of the molds is very ingenious. The machine is of the type in which the molds are hung vertically and carried from the mixer around a track to a point where they are pushed out of the molds.



Lime kilns built by A. Courchesne



New type of gypsum block being made by the Blue Diamond Co. of Los Angeles

El Paso, Texas, is always interesting to anyone who is interested in rock products as these form so large a part of the industries of the place. The Southwestern Portland Cement Co. there has made a number of important improvements in its plant, one of which is a new form of tube mill for raw grinding, imported from Germany. The kilns have been "bottle-necked" from 8 to 10 ft. diameter in the burning zone and this

has given them nearly 50% increased capacity beside a better control of the burning.

A. Courchesne, of El Paso, that pioneer in the rock products industries, although 76 years of age, is still active and interested in all that goes on. He is financially interested in the cement plant and formerly ran lime kilns and a crushing plant, but has now disposed of these. Recently he and his sons have built a flux stone plant for supplying the El Paso smelter with limestone that is one of the neatest and most cheaply operated plants to be found anywhere. One of his sons, Albert, who is now abroad, is responsible for the design of the plant and another son, Thomas, has charge of its operation.

Mount Franklin, near El Paso, around which are grouped the plants mentioned and the crushing plant of Dudley and Orr, is a wonderful deposit of limestone, not only on account of its purity but because almost every known kind of limestone may be found in it somewhere, from pure high-calcium lime to almost pure dolomite and with varying amounts of silica. It is so large (the limestone part of it runs for several miles back from the city) that there is plenty of every kind so that each may be the basis of an industry. At one point the cement company can quarry a cement rock that hardly needs the addition of shale and at another, limestone is obtained to be burned for chemical uses.

There is a large production of crushed rock from the plant of Dudley and Orr, used for building and highway purposes. In fact the city has been built from materials which came almost wholly from the mountain and the "mesa" beside it.

The "lime king" of El Paso is Clarence North, president of the El Paso Building Materials Co. which operates the old Courchesne kilns and also those formerly run by the Mount Franklin Lime Co. A large part of his production is sold for a use which is new to the writer, at least, that of furnishing alkalinity to the solutions used in the flotation process, which is now the favorite method of concentrating copper ores. The use is one that runs into tonnage as about 200 tons a day are used in the El Paso district. It is said that the Utah Copper Co., in one of its Utah plants, uses 100 tons daily. Lime is also used in another branch of the copper industry, a considerable quantity being needed as a binder for the briquettes into which the fine ore is made before they are smelted.

Mexican labor is fairly cheap in El Paso and that is why old-fashioned methods are still found at the kilns. The fuel is added with the limestone and only anthracite is used. In spite of this fact, lime is produced and sold as cheaply as at any point in the country, the selling price being less than half of some of the current quotations for lump lime in ROCK PRODUCTS.

J. Shehan, a former partner of Mr. North, is building a new lime kiln which will be in operation shortly.

Henry G. Shirley to Head American Road Builders' Association

AT a meeting of the nominating comtee held in New York, Henry G. Shirley, chairman of the Virginia State Highway Commission was unanimously chosen as president for 1926-1927 of the American Road Builders' Association, the oldest and foremost organization identified with the good roads program in this country and the sponsor of the great good roads convention and exposition to be held in Chicago, January 11-15, next.

Nomination to this important post is equivalent to election as the recommendations of the nominating committee have been endorsed without exception throughout the 25 years of the association's existence. The election of officers will be by ballot of the membership between now and the Chicago convention where the vote will be canvassed and the result announced. The new officers will be installed at the New York meeting of the association next May.

In addition to Mr. Shirley for president, the nominating committee, of which Col. R. Keith Compton, director of Public Works at Richmond, Va., is chairman, has nominated the following for the four vice-presidencies to be filled at the Chicago meeting: W. R. Smith, president, Lane Construction Corporation, Meriden, Conn.; S. T. Henry, director, Pan-American Confederation for Highway Improvement, Spruce Pine, N. C.; S. F. Beatty, Austin-Western Road Machinery Co., Chicago, Ill., and Samuel Hill, honorary life president, Washington Good Roads Association, Seattle, Wash.

James H. MacDonald, former state highway commissioner of Connecticut and a road expert residing at New Haven, will continue as treasurer. Charles M. Upham, state highway engineer, Raleigh, N. C., is business director and convention manager of the association and Miss Ethel A. Birchland of New York is secretary.

The following men have been nominated for the seven directorships to be filled at the Chicago meeting: F. A. Reimer, consulting highway engineer, East Orange, N. J.; W. H. Kershaw, The Texas Co., New York City; C. M. Pinckney, chief engineer, Bureau of Highways, Manhattan Borough, New York City; Col. R. Keith Compton, director of public works, Richmond, Va.; C. M. Upham, state highway engineer, Raleigh, N. C.; William Ogden, Lakewood Engineering Co., Cleveland, O., and Frank Terrace, president, Washington Good Roads Association, Orillia, Wash.

Mr. Shirley, who will become president, has long been identified with America's highway program and is widely known for his achievements in the construction field. After graduating in engineering at the Virginia Military Institute, he became roads engineer for Baltimore County, Md., and then highway commisioner of that state. At one time he was secretary of the American Highway Industries Association and president of the American Association of State Highway Officials. During the World War he was a member of one of the committees assisting the government with wartime highway matters.

The board of directors of the American Road Builders' Association, as at present constituted, includes: W. H. Connell, chief engineering executive, Pennsylvania Highway Department, Harrisburg, Penn., president; Frank Page, chairman, North Carolina State Highway Commission, Raleigh, N. C.; J. H. Cranford, president, Cranford Paving Co., Washington, D. C.; J. R. Draney, Draney Asphalt Co., New York City; John B. Hittell, chief street engineer, Board of Local Improvements, Chicago, Ill.; Lewis S. Louer, vice-president, *Engineering and Contracting*, Chicago, Ill.; R. A. Meeker, right of way engineer, New Jersey State Highway Department, Trenton, N. J.; Frank T. Sheets, chief highway engineer, Illinois Department of Public Works, Springfield, Ill.; W. A. Van Duzer, equipment and transport engineer, Pennsylvania Highway Department, Harrisburg, Penn.; B. H. Wait, district engineer, Portland Cement Association, New York City; H. K. Bishop, chief, division of construction, U. S. Bureau of Public Roads, Washington, D. C.; H. S. Carpenter, deputy minister of highways, Regina, Sask., Can.; Paul L. Griffiths, American Tar Products Co., Chicago, Ill.; J. E. Pennybacker, general manager, The Asphalt Association, New York City; W. H. Stone, *Manufacturers' Record*, Baltimore, Md.; John E. Tate, district engineer, Portland Cement Association, Charlotte, N. C., and T. J. Wasser, Public Service Production Co., Newark, N. J.

The executive committee is composed of W. H. Connell, president; J. H. MacDonald, treasurer; S. F. Beatty, Chicago; J. H. Cranford, Washington, D. C., and H. G. Shirley, Richmond, Va.

National Research Council New Assistant Director

ANNOUNCEMENT is made by Director Charles M. Upham, Highway Research Board of the National Research Council, that Professor S. S. Steinberg of the University of Maryland has been appointed assistant director of the board. He will also for the present continue to serve as acting secretary of the investigation on the development of earth roads now being conducted under the auspices of the Highway Research Board. Professor Steinberg served as assistant director during the summer of 1924.

H. F. Janda, former assistant director, has been designated secretary to research committees in accordance with the new policy of the board to employ technical assistants who shall devote full time to research committee work. Professor Janda will return to his duties at the University of North Carolina on January 1, 1926, at the expiration of his leave of absence.

Virgil George Marani

Virgil George Marani, chief engineer of the Gypsum Industries, died of cerebral hemorrhage at his home in Evanston, Ill., Monday, November 2, 1925. He was 56 years of age.

Of all the men who have been active in the development of the various rock products industries, few have had the vision and the power to communicate it to others that Mr. Marani displayed in the gypsum industry. He was first of all an engineer, and as such he was known throughout the engineering profession in the United States before he took up his work with the Gypsum Industries. But he had what too few engineers are able to acquire, the power to impress others with his ideas. This was partly due to his personality and his gift for friendship, but it was also due to the confidence he had in the industry which has been so amply justified by the developments of the last few years.

Readers of Rock Products will remember him from the numerous articles from his pen which have appeared in this paper. But they cannot know him as did those who were fortunate enough to have a personal acquaintance with his geniality and charm. His death is a severe loss to the industry he represented so ably, but it is a real grief to those who were his friends.

He was born July 4, 1868 at Reggio, Italy, the son of an Italian father and a Scotch mother. He was left an orphan at an early age and was sent to Edinburgh, Scotland, with his two brothers. As is so often the case with boys of an active and intelligent mind, he wanted to see the world at an early age, so he ran away from home when he was only 11 years old. By way of discipline he was placed on H. M. S. *Conway,* from which he was honorably discharged after two years. But the urge to see new lands and strange places persisted and he shipped on a sailing vessel and followed the sea until his 21st year. In that period he twice sailed around the earth and doubled Cape Horn and the Cape of Good Hope a number of times.

Then he came into some money from his mother's estate and spent it wisely in getting an education. He went through high school and college in four years, graduating from Toronto University in 1893. Recently he received a C. E. degree from this university as an acknowledgment of his later work.

Soon after he settled in Cleveland where most of his professional work was done. He was draftsman, inspector and finally building commissioner for the city, but for 10 years of the time he spent in Cleveland he was chief engineer of the Cleveland Gas Light and Coke Co. He was also in consulting practice, the firm being known as Marani and Moore.

During this period he designed almost every type of building used in this country, residences, warehouses and manufacturing buildings. It was at this time that he made that intensive study of structures and materials that caused him to be known as an authority in construction engineering.

This was recognized by the National Fire Proofing Co. of Pittsburgh, which made him its consulting engineer and afterward by the United States Gypsum Co., for which he was engineer until the war when he became gypsum representative of the War Service Committee, retaining that position until 1918, when he was chosen to be chief engineer of the Gypsum Industries, a position which he held until his death.

Virgil George Marani

Mr. Marani was a member of important technical and scientific societies including the American Society of Civil Engineers, the American Association of Engineers, the American Society for Testing Materials, the Western Society of Engineers, the Cleveland Engineering Society and the National Fire Protection.

The funeral was held from his home in Evanston November 3, and the interment was in Cleveland November 4.

Freighter Pallas Carries Its First Gypsum Cargo

WITH 7000 tons of bulk gypsum in her holds, the former Shipping Board freighter Pallas, which was recently purchased by the Standard Gypsum Co., arrived at Los Angeles harbor from Mexico. The vessel sailed from San Marcos Island in the Gulf of Lower California, where the Standard company have recently opened their large gypsum deposits.

The big steamship will proceed to Long Beach, where she will berth at the new plant recently built there by the gypsum company at a cost of more than $200,000. Specially designed traveling cranes and conveyors will be used to discharge the bulk cargo in record time.

W. C. Riddle, engineer in charge at the new Long Beach plant, announced his belief that the Pallas is bringing the largest cargo of gypsum ever handled in a steamship. The product will be manufactured into various commodities, chiefly wall board, hollow tile, etc. The gypsum official stated that a stockpile of the raw material, which will be brought up from Mexico, will be constantly on hand. The pile will constitute about 20,000 tons.

Heretofore the three Los Angeles gypsum plants which manufacture gypsum products have obtained the crude gypsum by rail from deposits in Nevada. It is expected that the all water route from the San Marcos Island to Los Angeles will materially facilitate operations of these plants.

A Case of Mistaken Identity

ON page 81 of Rock Products, October 31, under the caption "The Tail of the Comet," reference was made to a "flurry a couple of years ago by some gentlemen who were going to revolutionize the lime industry with a quick-setting lime plaster." We had jumped to conclusion that the patent specifications that we published were those covering the material promoted by A. A. Alles, Jr., and his associates about two years ago.

Our error has been pointed out to us by two different individuals, and we apologize for our error and hasten to correct it. Below is a letter from A. A. Alles, which explains the matter:

"I am just in receipt of copy of Rock Products for October 31.

"Referring to the article that appears, would like to say that I believe you put the 'Tail of the Comet' on the wrong fellow, as I was never in the lime business.

"If you will look over your back files and get the name and address of the directors of that company, and write to them all, I believe one and all of them will say that Albert A. Alles, Delaware Charters, 1504 Federal street, Pittsburgh, Penn., was in no way connected with them, never held stock, never was consulted in any matter pertaining to the company, except that I secured for them their charter.

"For the entire period that the plaster factory was in operation I believe I only called two or three times, and that was to see my son, A. A. Alles, Jr., who lived in a neighboring community.

"There is quite a difference in my invention and the Harrison patents, 'Piercite.'

"I never thought of trying to make a hardening compound until after the failure of the company referred to."

A. A. ALLES.

Financial News and Comment

Wolverine Cement Conserves Its Cash

IN the midst of declarations of extra cash dividends and splitting up of rich melons, the Wolverine Portland Cement Co. of Chicago, Ill., deferred the payment of a quarterly dividend of 20 cents a share due November 15. In the language of the directorate this was done to conserve cash resources with the view to carrying over until next spring an inventory of products to meet the usual seasonal demand for building material. In the light of the year's events this is considered extraordinary, particularly as a fixed price for cement prevents competitive encroachments and 1925 has been a record-breaking period in the building industry.

Dividends paid so far this year amount to 6% on the $10 par stock. Current assets are $423,902 and current liabilities $27,403. Cash totals $155,461.—*The Economist.*

Missouri Portland Cement Company to Retire Bonds

THE directors on October 20 authorized the call for redemption on January 1, 1926, of all outstanding bonds of this company maturing on July 1, 1936, and July 1, 1937, amounting in the aggregate to $491,000.

A regular quarterly dividend of 50 cents per share has been declared on the outstanding capital stock, par $25, payable on October 31.

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS

(These are the most recent quotations available at this printing. Revisions, corrections and supplemental information will be welcomed by the editor.)

Stock	Date	Par	Price bid	Price asked	Dividend rate
Alpha Portland Cement Co. (common)**	Nov. 6	100	145	149	1¾% quar. Sept. 1
Alpha Portland Cement Co. (preferred)**	Nov. 6	100	110	....	1½% quar. Sept. 1
Arundel Corporation (sand and gravel—new stock)	Nov. 10	No par	35¾	36⅛	30c quar. Oct. 1
Atlas Portland Cement Co. (common)	Nov. 11	No par	54⅛	55½	50c quar.
Atlas Portland Cement Co. (preferred)	....	100	....	....	2% quar. Oct. 1
Atlas Portland Cement Co. (preferred)**	Nov. 6	33⅓	45	....	2% quar. Oct. 1
Bessemer Limestone and Cement Co. (common)‡	Nov. 9	100	132¾	140	1½% quar. Oct. 1
Bessemer Limestone and Cement Co. (preferred)‡	Nov. 9	100	105½	106½	1¾% quar. Oct. 1
Bessemer Limestone and Cement Co. (convertible 8% notes)‡	Nov. 9	....	112	125	8% annual
Boston Sand and Gravel Co. (common) (r)	Oct. 31	100	63	70½	2% quar. July 1
Boston Sand and Gravel Co. (preferred) (d)	Nov. 6	....	....	80	1¾% quar. Oct. 1
Boston Sand and Gravel Co. (1st preferred) (d)	Nov. 6	....	....	90	2% quar. Oct. 1
Canada Cement Co., Ltd. (common)	Nov. 9	100	106½	107½	1½% quar. Oct. 16
Canada Cement Co., Ltd. (preferred) (f)	Nov. 6	100	115	115½	1¾% quar. Nov. 16
Canada Cement Co., Ltd. (1st 6's, 1929) (f)	Nov. 6	....	102	103	3% semi-annual A&O
Canada Crushed Stone Corp., Ltd. (6½s, 1944) (f)	Nov. 6	100	96	99	
Charles Warner Co. (lime, crushed stone, sand and gravel)	Nov. 9	No par	22	25	50c quar. Oct. 10
Charles Warner Co. (preferred)	Nov. 9	100	99	102½	1¾% quar. Oct. 22
Charles Warner Co. (lime, crushed stone, sand and gravel) 7s, 1929 (r)	Oct. 31	100	104	....	
Connecticut Quarries Co. (1st Mortgage 7% bonds) (s)	Nov. 5	100	102	103	
Dolese and Shepard Co. (crushed stone) (a)	Nov. 11	50	54½	56	1½% quar.
Edison Portland Cement Co. (common)	Nov. 3	50	7½c(x)	....	
Edison Portland Cement Co. (preferred)	Nov. 3	50	17½c(x)	....	
Giant Portland Cement Co. (common)**	Nov. 6	50	40	45	
Giant Portland Cement Co. (preferred)**	Nov. 6	50	54	57	3½% semi-ann. June 15
Ideal Cement Co. (common)‖	Nov. 6	No par	74	78	$1 quar. June 30
Ideal Cement Co. (preferred)‖	Nov. 6	100	106	108	1¾% quar. June 30
International Cement Corporation (common)	Nov. 11	No par	70⅝	72½	$1 quar. Sept. 30
International Cement Corporation (preferred)**	Nov. 9	100	104½	104⅞	1¾% quar. Sept. 30
International Portland Cement Co., Ltd. (preferred)	Mar. 1	....	30	45	
Kelley Island Lime and Transport Co.	Nov. 11	100	115	117	2% quar. Oct. 1
Lawrence Portland Cement Co.**	Nov. 6	100	110	....	2% quar.
Lehigh Portland Cement Co.‖	Nov. 6	50	88	91	1½% quar.
Lyman Richey Sand and Gravel Co. (1st Mort. 6s, expire serially up to 1930) (k)	Nov. 9	100	99	100½	
Lyman Richey Sand and Gravel Co. (1st Mort. 6s, expire serially from 1930 to 1935) (k)	Nov. 9	100	96½	98½	
Michigan Limestone and Chemical Co. (common)‖	Nov. 6	....	23	....	
Michigan Limestone and Chemical Co. (preferred)‖	Nov. 6	....	23	....	1¾% quar. July 15
Missouri Portland Cement Co.	Nov. 11	25	68	69½	50c quar.; 25c ex. Aug 1
Missouri Portland Cement Co. (serial bonds)	May 29	....	104½	104½	3¼% semi-annual
Monolith Portland Cement Co. (common) (c)	Nov. 7	....	8¾	9¼	
Monolith Portland Cement Co. (units) (c)	Nov. 7	....	24¼	25¾	
Monolith Portland Cement Co. (preferred) (c)	Nov. 7	....	7¾	8¼	
New England Lime Co. (Series A, preferred) (i)	Nov. 5	100	96½	99	
New England Lime Co. (Series B, preferred) (i)	Nov. 5	100	96½	99	
New England Lime Co. (V.T.C.) (i)	Nov. 5	....	23	25	
New England Lime Co. (6s, 1935) (m)	Nov. 9	100	97½	100	
North American Cement Corp. 6½s 1940 (with warrants)	Nov. 9	....	97¾	98½	
North American Cement Corp. (preferred)	Oct. 24	100	....	....	2 mo. period at rate of 7%
Olympic Portland Cement Co. (g)	Oct. 13	....	....	£1⅝	
Pacific Portland Cement Co., Consolidated (§)	Nov. 6	100	88	89	
Pacific Portland Cement Co., Consolidated (secured serial gold notes)§	Nov. 6	....	99½	100¼	3% semi-annual Oct. 15
Peerless Portland Cement Co.*	Nov. 9	10	6	7	
Petoskey Portland Cement Co.*	Nov. 9	10	9	10	1½% quar.
Pittsfield Lime and Stone Co. (preferred)	....	100	....	....	2% quar. Apr. 1
Rockland and Rockport Lime Corp. (1st preferred) (d)	Nov. 6	100	....	98	3½% semi-annual Aug. 1
Rockland and Rockport Lime Corp. (2nd preferred) (d)	Nov. 6	100	....	70	3% semi-annual Aug. 1
Rockland and Rockport Lime Corp. (common) (d)	Nov. 6	No par	....	70	1½% quar. Nov. 2
Sandusky Cement Co. (common)*	Nov. 11	100	107	112	2% quar. July 1
Santa Cruz Portland Cement Co. (bonds) (§)	Nov. 6	....	104	106	6% annual
Santa Cruz Portland Cement Co. (common) (§)	Nov. 6	50	85	97	$1 April 1
Superior Portland Cement Co.	Mar. 1	100	....	120	
United States Gypsum Co. (common)	Nov. 11	20	191	192½	2% quar. Sept. 30; $1 ex. Sept. 15
United States Gypsum Co. (preferred)	Nov. 11	100	117	117	1¾% quar. Sept. 30
Universal Gypsum Co. (common)†	Oct. 28	No par	20½	23	
Universal Gypsum V. T. C.†	Oct. 28	No par	19	22	
Universal Gypsum Co. (preferred)†	Aug. 5	....	76	....	1¾% quar. Sept. 15
Universal Gypsum Co. (1st mortgage 7% bonds)†	Oct. 28	....	99	(at 6½%)	
Union Rock Co. (7% serial gold bonds) (y)	Nov. 3	100	99	101	
Wabash Portland Cement Co.*	Aug. 3	50	60	100	
Wisconsin Lime and Cement Co. (1st Mort. 6s, 1940) (o)	Nov. 9	100	98½	100	
Wolverine Portland Cement Co.	Nov. 10	10	6¼	6½	2% quar. Aug. 15

*Quotations by Watling, Lerchen & Co., Detroit, Mich. **Quotations by Bristol & Bauer, New York. †Quotations by True, Webber & Co., Chicago. ‡Quotations by Butler, Beadling & Co., Youngstown, Ohio. §Quotation by Freeman, Smith & Camp Co., San Francisco, Calif. ‖Quotations by Frederic H. Hatch & Co., New York. (a) Quotations by F. M. Zeiler & Co., Chicago, Ill. (b) Quotations by De Fremery & Co., San Francisco, Calif. (c) Quotations by A. E. White Co., San Francisco, Calif. (d) Quotations by Lee, Higginson & Co., Boston, Mass. (f) Nesbitt, Thomson & Co., Montreal, Canada. (g) Neidecker and Co., Ltd., London, England. (i) E. B. Merritt & Co., Inc., Bridgeport, Conn. (k) Peters Trust Co., Omaha, Neb. (m) Second Ward Securities Co., Milwaukee, Wis. (o) Central Trust Co. of Illinois, Chicago, Ill. (r) J. S. Wilson Jr. Co., Baltimore, Md. (s) Chas. W. Scranton & Co., New Haven, Conn. (x) Price obtained at auction by Barnes and Lofland, Philadelphia, on Nov. 3, 1925. (y) Dean, Witter & Co., Los Angeles, Calif.

Editorial Comment

A Healthy Condition

The impression left by a recent visit to the Pacific Coast is that the rock products industries there are in a very healthy state. There is no fatty degeneration from too much of a sellers' market and no anaemia from lack of demand. Actual figures for construction in the first seven months of the year show a 9% increase over the same period for last year. Three of the principal cities, Seattle, San Francisco and Los Angeles, show about the average gain, other places show decreases, but these are more than balanced by large increases in other places.

There is a feeling that there are still more plants than are needed to fill orders, but somehow all of them are making a living and some of them are doing much better. Where new plants are building there is usually some special reason for their being built, such as the possibility of reducing costs by a better plant or the taking advantage of freight rates. The "sand war" that rose to such absurd proportions during the early part of the year in Los Angeles, is said to have "scared off" some prospective producers, and in that respect it was perhaps a good thing.

Better construction is accounting for an increased use of rock products and will account for a lot more of it. "Pasteboard houses" and cheap frame constructions are being displaced by the better types. With concrete block construction costing only 10% more than good frame construction there is no doubt as to which type gives the builder the most for his money. In at least one case a professional builder was able to sell concrete block houses at a better profit than frame houses, showing that people are willing to pay for permanency.

Important research work is going on in a number of plants caused not only by competition but by a real desire to make a better product. And this is a sign of health quite as much as a sound economic state of the industries.

A Generally Unappreciated Asset

Difficulties encountered by the Albany Crushed Stone Co. in developing a quarry face, as described in our issue of October 31, furnish the best possible proof of the investment all quarry operators have to make in quarry development; but which is seldom charged to capital account as it really should be. The chief difference between the case of the Albany Crushed Stone Co. and other operations is that in most cases quarry development work is a long-time process, and the cost comes out of the profits of operation, while in this case the capital for this purpose had to be supplied from outside sources.

Therefore the owners of the Albany Crushed Stone Co. know that they have a capital investment in quarry development, while many other quarry owners perhaps do not know it, or at least have not half so keen an appreciation of the fact. Probably, whether a part of the cost of quarry development is charged to production or to capital account does not make much difference to the operator until the occasion arises to place a real value on a going quarry operation, in which case it is, or should be, recognized that the true value includes more than the price of the property, the buildings, and the goodwill.

Nearly all large quarry projects have been through the experience of the Albany Crushed Stone Co. It is almost invariably the rule that about twice the amount of money originally expected to be invested has to be invested before a satisfactory production stride is reached. We do not believe this fact should be glossed over, but, for the good of the industry, should be emphasized upon every available occasion.

In the mining industry, engineers better appreciate the cost of development, and they are careful to draw a sharp line between what they call "dead work" and work which is only for the extraction of ore. Conditions are perhaps not so good for quarrymen to separate the costs of such work but the difference exists just the same. The point we want to drive home is that a quarry face represents a lot of money spent for purely development purposes. We know of cases in which ignorance or lack of appreciation of this fact has brought sound companies to the verge of bankruptcy. And in other cases this ignorance has caused the owners of successful operations to place too low a valuation on what is really their principal asset.

"American Waste"

A writer in *Harper's Magazine* complains of the American habit of waste and instances the tearing down of one building only to put up another, as an example. It is a poor example. The real waste is in allowing buildings to stand after they become eyesores and a menace to surrounding buildings. There are areas in all the older American cities which were built over before concrete, gypsum and similar materials were much used, that keep the firemen busy, and every now and then one of these is the scene of a fire which horrifies the public on account of the loss of life. Surely it is not waste to pull down such buildings and replace them with those of modern construction. Vermin which spread disease mostly inhabit the older buildings for walls of rock products allow them no lodgement. Finally, there is the important fact that each age expresses itself in its buildings and the older buildings are unworthy of this age.

Analysis of Cement Imports Into the United States*

By J. S. McGRATH

Minerals Division, Bureau of Foreign and Domestic Commerce, United States Department of Commerce

DURING 1924, the output of the American portland cement industry was greater than that of any previous year in its history. The prospects for the curent year are for an even greater annual production.

A continual increase in annual production and domestic sales over a period of years does not alone complete the picture presented by the American portland cement industry. In addition to these data must also be considered the effect our foreign trade in this product has upon the domestic industry. This paper is not intended to furnish a remedy for existing conditions, but merely to show, by figures carefully compiled, the situation of the American portland cement industry with particular respect to its natural markets, both foreign and domestic, and the competition encountered therein from foreign producers. All figures submitted herein have been secured from United States government official sources. Statistics for 1925, however, are not final figures and are subject to possible revision.

The following table (No. 1) shows a steady increase in the annual output, shipments, and number of plants producing portland cement in the United States during the years 1913 to 1925, inclusive. However, the continual increase in our annual imports of foreign cement, combined with the very noticeable decrease in our exports of this product, must also be considered in order to clearly understand the present situation of the American portland cement industry.

With respect to the competition encountered by domestic manufacturers of portland cement from foreign producers, it will be noted from the accompanying table No. 3 that only those markets located along the border of the continental confines of the United States (including Porto Rico and Hawaii) are actually affected. Foreign cement has not as yet entered inland markets to any appreciable extent.

The foregoing table No. 3 serves to show the total quantity of portland cement, from all countries, which entered the various customs districts of the United States during the last five years.

After reviewing table No. 3 it is natural to inquire as to what proportion of the total quantity of cement imported through each of the customs districts was contributed by the individual foreign suppliers. This query is answered by table No. 3 (a).

Paragraph 1543, Free List, of the Tariff Act of 1922 on Imports into the United States stipulates that Roman, portland and other hydraulic cement may be imported into

*From Special Group Bulletin No. 14 of the Department of Commerce.

TABLE 1

Year	Active Plants	Production Bbls. 376 lb.	Shipments Bbls. 376 lb.	Total Imports Bbls. 376 lb.	Total Exports Bbls. 376 lb.
1913	113	92,097,131	88,689,377	81,338	3,999,715
1918	114	71,081,663	70,915,508	302	2,252,446
1919	111	80,777,935	85,612,899	8,507	2,463,573
1920	117	100,023,245	96,311,719	503,234	2,985,807
1921	115	98,942,049	95,507,147	122,317	1,181,014
1922	118	114,789,984	117,701,216	323,823	1,127,845
1923	126	137,460,238	135,912,118	1,678,636	1,001,688
1924	132	148,859,000	145,747,000	2,010,936	878,543
1925 (9 months)	137	120,841,000	124,311,000	2,436,846	744,080

TABLE 2. ROMAN, PORTLAND AND OTHER HYDRAULIC CEMENT—INTO THE U. S.

(In barrels 380 pounds prior to 1920 and barrels 376 pounds 1920 to date)

Countries of origin	1913	1918	1919	1920	1921	1922	1923	1924	1925*
Austria-Hungary			7,074						
Belgium	623				19,390	10,682	200,719	1,018,426	1,371,345
Denmark	53			211	11,464	118,500	370,410	312,986	213,402
Esthonia								33,368	33,690
France	10,585			18	621	1,668	1,704	5,451	10,545
Germany	57,291			1,033	1,318	6	47,344	11,957	12,808
Italy	5				5			6	
Norway	210				3,148	125	420,232	525,590	412,702
Poland				2,460	11,316	6			
Netherlands					1,215	149	1,996	6,499	
Spain		29			2			6	
Sweden						60,492	211,555	15,465	
Turkey						24	95		
Switzerland								12	
United Kingdom	623	7		384	2,570	12	186,152	28,852	3,431
Canada	253	264	1,428	498,429	53,648	127,215	228,593	42,953	372,912
China	11,695				111				
Dominican Rep.					3,231	53			
Japan			1		4,720	3,890	48	1,412	5,683
Mexico				593	170	1,001		2,788	
Philippine Islands								5,010	
Virgin Islands of U. S.				106	9,365		9,788	135	322
Panama		2	4		7				
Cuba					16				6
Totals	81,338	302	8,507	503,234	122,317	323,823	1,678,636	2,010,936	2,436,846

*Nine months.

TABLE 3. IMPORTS OF ROMAN, PORTLAND AND OTHER HYDRAULIC CEMENT BY CUSTOMS DISTRICTS (In Barrels of 376 Pounds)

Customs districts—	1921	1922	1923	1924	1925*
San Diego		906			
Maine and New Hampshire	1,561	614	3,205	3,324	29,394
Massachusetts			6,202	58,216	210,757
St. Lawrence	3,026	9,818	44,329	3,837	145,260
New York	12,840	810	63,358	75,046	14,108
Philadelphia		6		167,654	222,892
South Carolina			36,186	10,580	20,023
North Carolina		107,794	168,596		
Florida		20,017	103,761	121,836	523,100
New Orleans	273	12	92,644	93,294	110,414
Los Angeles			408,198	613,605	344,215
San Francisco	3,156	11,694	102,796	106,865	110,731
Washington	3,558	6,869	21,560	126,512	147,549
Hawaii	4,830	3,890	72,323	226,556	157,616
Porto Rico	89,099	105,511	248,729	333,230	214,438
Galveston			3,753	12	
Georgia			18,575		
Oregon		203	111,511	34,094	77,679
Vermont	1,813	37,038	91,763	27,237	48,386
Rochester		11,992	5,618	2,580	9,258
Buffalo	197	310	66,801	6,458	49,816
Chicago		6			
Virginia			5,618		1,150
San Antonio	170	101			
Maryland			2,502		
Alaska	982				
Dakota	364	185	453		60
Michigan	543	5,648	155		
Duluth and Superior		399			
Total	122,317	323,823	1,678,636	2,010,936	2,436,646

*Nine months, January-September, inclusive.

TABLE 3a. IMPORTS OF ROMAN, PORTLAND AND OTHER HYDRAULIC CEMENT BY COUNTRIES OF ORIGIN AND CUSTOMS DISTRICTS OF ENTRY

		1924			1925*		
Countries of origin	Customs districts of entry	Barrels 376 lb.	Dollars	Pct. of total from each	Barrels 376 lb.	Dollars	Pct. of total from each
		1924			1925*		
Countries of origin	Customs districts of entry	Barrels 376 lb.	Dollars	Pct. of total from each	Barrels 376 lb.	Dollars	Pct. of total from each
Belgium	New York	65,849	90,020		6,327	8,104	
	Philadelphia	161,006	168,875		222,892	303,445	
	Florida	44,663	63,097		370,940	575,263	
	Los Angeles	502,302	855,996		338,567	507,905	
	San Francisco	67,200	116,993		90,738	152,011	
	Washington	45,366	84,474		74,540	141,578	
	Massachusetts	54,892	82,468		118,607	212,047	
	Virginia	0	0		1,150	1,749	
	Oregon	16,192	35,991		50,555	81,603	
	South Carolina	3,003	3,900		11,027	14,999	
	New Orleans	3,008	3,900		44,258	62,406	
	Hawaii	35,745	50,048		35,846	50,466	
	Porto Rico	16,145	18,028		5,898	11,000	
	Galveston	6	7		0	0	
	Maine and New Hampshire	2,949	3,996		0	0	
	Total	1,018,426	1,577,793	50.64	1,371,345	2,122,576	56.20

(Table continued on next page)

Denmark	Porto Rico	312,909	438,358		208,171	295,491	
	Chicago	0	0		....	11	
	San Francisco	0	0		1,990	3,285	
	Oregon	0	0		250	600	
	Washington	0	0		2,991	3,413	
	New York	77	811		0	0	
	Total	312,986	439,169	15.56	213,402	302,800	8.76
Norway	Galveston	6	15		0	0	
	South Carolina	7,578	11,514		8,996	13,348	
	Florida	77,173	117,967		34,649	60,295	
	New Orleans	50,102	102,590		50,614	85,891	
	Los Angeles	100,222	152,046		4,998	8,000	
	San Francisco	31,479	45,885		15,239	22,398	
	Oregon	11,671	21,096		26,874	42,490	
	Washington	75,773	120,704		69,863	108,124	
	Hawaii	155,506	249,214		82,397	128,305	
	Massachusetts	2,055	3,190		92,150	157,274	
	Maine and New Hampshire	0	0		26,922	39,333	
	New York	3,354	5,588		0	0	
	Porto Rico	4,022	5,640		0	0	
	Philadelphia	6,649	9,224		0	0	
	Total	525,590	844,673	26.14	412,702	665,458	16.94
United Kingdom	Massachusetts	596	1,080		0	0	
	New Orleans	22,930	31,288		2,734	4,827	
	Los Angeles	0	0		650	2,014	
	Porto Rico	0	0		47	62	
	Ohio	0	0		....	10	
	New York	78	161		0	0	
	Oregon	4,998	11,061		0	0	
	San Francisco	250	441		0	0	
	Total	28,852	44,031	1.43	3,431	6,913	0.14
Esthonia	Hawaii	33,368	49,464		33,690	82,830	
	Total	33,368	49,464	1.66	33,690	82,830	1.38
Sweden	Los Angeles	8,293	12,249		0	0	
	New York	119	1,469		0	0	
	Washington	3,080	4,107		0	0	
	Oregon	1,233	9,458		0	0	
	San Francisco	2,740	4,511		0	0	
	Total	15,465	31,794	0.77	0	0	0
Germany	New Orleans	11,242	16,677		12,808	12,883	
	New York	661	1,013		....	4	
	San Francisco	54	120		0	0	
	Chicago	....	4		0	0	
	Total	11,957	17,814	0.60	12,808	12,887	0.53
Netherlands	Virginia	....	3		0	0	
	Massachusetts	500	800		0	0	
	New Orleans	5,999	12,600		0	0	
	Total	6,499	13,403	0.32	0	0	0
France	New York	4,790	6,965		7,781	16,552	
	San Francisco	655	1,504		2,764	1,095	
	New Orleans	6	17		0	0	
	Chicago	....	14		0	0	
	Massachusetts	....	12		0	0	
	Total	5,451	8,512	0.27	10,545	17,657	0.43
Switzerland	Total—New York	12	57		0	0	
Italy	Total—New York	6	11		0	0	
Spain	Total—New Orleans	6	10		0	0	
Greece	Total—New York	0	0		....	3	
Canada	Washington	2,293	7,753		155	524	
	Buffalo	6,458	10,424		49,816	80,358	
	Dakota	0	0		60	184	
	Maine and New Hampshire	376	833		2,472	5,179	
	Vermont	27,237	42,152		48,386	71,540	
	St. Lawrence	3,836	6,392		145,260	227,266	
	Rochester	2,580	3,252		9,258	11,068	
	Florida	0	0		117,505	168,892	
	Massachusetts	173	300		0	0	
	Total	42,953	71,106	2.14	372,912	565,011	15.30
Philippine Islands	Hawaii	1,191	2,980		0	0	
	San Francisco	3,819	9,125		0	0	
	Total	5,010	12,105	0.25	0	0	0
Japan	Hawaii	745	1,427		5,683	8,583	
	San Francisco	667	1,133		....	3	
	Total	1,412	2,560	0.07	5,683	8,586	0.23
Virgin Is. of U. S.	Total—Porto Rico	155	215		322	430	
Cuba	Total—Florida	0	0	0.15	6	31	0.01
Mexico	Total—Los Angeles	2,788	3,845		0	0	
China	Total—San Francisco	....	2		0	0	
	GRAND TOTAL	2,010,936	3,116,564	100.00	2,436,846	3,785,172	100.00

*January-September, nine months.

the United States free of duty, provided—"That if any country, dependency, province or other subdivision of government, imposes a duty on such cement imported from the United States, an equal duty shall be imposed upon such cement coming into the United States from such country, dependency, province, or other subdivision of government."

As a result of this clause in the United States Tariff Act of 1922, Belgian, Danish, and British cement enters the United States free of duty while upon that exported to the United States from Norway, Sweden, Netherlands, Germany, France, Canada and Japan, is imposed a duty similar in amount to that levied upon cement entering these countries from the United States. (Definite information as to the present tariff status of cement imported from these countries may be obtained from the Division of Customs, Treasury Department, Washington, D. C.)

Although the entire importation of cement is only a small percentage of what the country uses, it is important because it is concentrated at a few points where it greatly affects the market.

Link-Belt Celebrates Fiftieth Anniversary

IN commemoration of their 50th year of existence, the Link-Belt Co. of Chicago have recently published a handsome little booklet, attractively illustrated and printed on excellent paper which is entitled "Link-Belt, 1875-1925." The book covers the history of the company's development from the time of the invention of the Ewart Detachable Link-Belt in 1874 by W. D. Ewart. The original company was incorporated in 1875 under the name of the Ewart Mfg. Co., with the backing of J. C. Coonley, for the purpose of manufacturing detachable link chain. New uses for the invention developed rapidly and in 1880 the Link-Belt Machinery Co. was incorporated "to design, build and supply accessory parts, and install elevators and conveying machinery employing Ewart chains." The plant for this company was built in Chicago. In 1888, the Link-Belt Engineering Co. was formed with a plant at Philadelphia. These two plants found increasing numbers of new uses for the chain, with the result that all three plants continued to grow in size until in 1906 a consolidation of the three interests took place, and Charles Piez elected president.

It will be remembered that Mr. Piez was Director General of the Emergency Fleet Corporation during the World War.

Mr. Piez is now chairman of the board of directors, and Alfred Kauffmann is now president of the company.

From the humble beginning in 1875 this company now operates and owns 10 large manufacturing plants, with seven shops and warehouses, and 27 branch offices, and its products now include elevating and conveying equipment for all kinds of materials.

Residents Protest Quarry Blasts

AS a result of heavy blasts, which are said to be set off daily by the Lynn Sand & Stone Co. at their quarry at Swampscott, Mass., residents of the district are planning legal action. Recently a blast was set off which is said to have rocked houses and buildings within a half mile radius of the quarry.

It is claimed by residents of the section that the company uses excessive charges of explosive for blasting purposes and that in consequence houses are shaken daily and, in some cases, damage is said to have been done to household goods by the blasts. Residents of the section say that they have appealed to Swampscott authorities for an abatement of the blasting, which they term a "nuisance," but have received no action, and now they are planning to place the case in the hands of legal advisors.

It is thought that the ledge which the company is blasting extends underneath some of the houses in the vicinity of the quarry and causes an excessive shaking. Several of the residents of the section stated this morning that they were not opposed to blasting in the vicinity provided it was carried on in a manner which would not endanger their homes.—*Lynn (Mass.) Item.*

Rock Dust as Preventive of Coal Dust Explosions Demonstrated

GEORGE W. GROVE, engineer at the Pittsburgh station of the United States Bureau of Mines, gave several demonstrations of rock dusting as a preventative of coal dust explosions when he visited Birmingham to attend the seventh annual first aid meet.

The first demonstration was given at the meet. On following days the demonstrations were repeated at Margaret, Sipsey, Coal Valley, Mulga, Majestic, Carbon Hill and Edgewater.

The demonstration is given in a glass cabinet about 6 ft. long. In one end of the cabinet a lighted miner's lamp is placed and in the other end a small quantity of coal dust is blown by compressed air. The coal dust is ignited by the lamp and a flame about 6 ft. long streams from the end of the gallery. Then Mr. Grove mixes rock-dust with the coal dust and repeats the experiment several times, each time decreasing and finally eliminating the explosion, showing that proper application of rock-dust in a mine will greatly reduce the fire and explosion hazard. The method is used in several mines. —*The Dixie Manufacturer.*

The grounded "Calcite" held two bridges open

Is Sugar Limestone Building Limestone?

ONE phase of the question of state rights to mineral land came before Judge Tillman D. Johnson of the federal court at Salt Lake City, Utah, in the suit of the Dunbar Lime Co. against the Utah-Idaho Sugar Co.

The Dunbar company holds a lease, originating from a state title, on land in Tooele county containing limestone deposits which, it is alleged, have been worked by the Utah-Idaho Sugar Co. which holds a lease assigned by mineral claimants.

The sugar company claims that the land never passed to Utah under the enabling act, relying on the supreme court decision in the Sweet case which involved land of known value for coal.

Counsel for the Dunbar company contend that the Sweet decision does not apply to the land in question.

Malon Wilson, who opened the case, said that there was a long controversy as to whether the federal mineral laws applied to stone. In 1892 Congress passed a law declaring that under the placer act, discoverers of building stone on the public domain could prove up on claims but with the provision that this should not apply to the injury of state school sections. He contends that limestone is building stone in the meaning of the law.

The Dunbar company asks damages of $20,000 for mineral already removed while the sugar company denies that it has removed limestone of this value. However, the point involved is the adjudication of the title to the land.—*Salt Lake City (Utah) Desert News.*

Crushing Company Entertains County Highway Officials

THE county commissioners and other officials of Montgomery county, Penn., attended a dinner tendered by the Birdsboro Stone Co. of Montgomery county, Penn., recently. Previous to the dinner, the visitors made an inspectoin of the company's quarries and crushing plant.—*Norristown (Penn.) Register.*

Large Crushed Stone Carrier Grounds in Chicago River

THE large lake freighter, *Calcite*, owned by the Michigan Limestone and Chemical Co., Calcite, Mich., and loaded with 6000 tons of crushed stone, went aground recently between two bridges in the Chicago river. The boat, which is 426 ft. long and 54 ft. wide, blocked all traffic in the channel and since the bridges had been opened to allow the boat to pass through, could not be closed while it lay in the channel, all movements generally over them, had to be rerouted. Efforts of six tugs failed to float it. The river level was then raised by closing the locks at Lockport, thus shutting off the river current.

It was said by harbor officials that the river level had been the lowest in years due to a strong south wind.

Gilmore Portland Cement Company Plant Sold

THE Gilmore City Portland Cement Co. plant at Gilmore City, Iowa, owned and operated for several years by a group of local people, has been sold to the Northwestern States Portland Cement Co. of Mason City, Iowa. The company was represented by C. H. McNider. The price paid was $600,000.

The bidding for the plant was confined to C. H. McNider and representatives of the Marquette Cement Co. of Chicago. Recently the Marquette people made a bid of $515,000 for the plant. This was raised to $550,000 by the Northwestern company.

At a meeting of the directors with the outside representatives, the Marquette organization increased its bid to $575,000. McNider then offered $600,000 for the plant, which was accepted.

Mr. McNider's offer also stipulates that material outside of the plant necessitates such as thousands of cement sacks, new and used, would be paid for extra at a fair agreed or arbitrated price.

The company's plant has been closed for several months while the officers had tried to dispose of the property. Several offers had been received, and each time a stockholders' meeting had been held earlier in the season, the proposals were presented and rejected.

The board of directors had previously stated that the plant could not earn enough to tide it over dull periods of the year.

The most valuable asset the corporation has are its extensive rock beds, containing raw material said to be sufficient for 73 years of manufacturing. A. C. Brown of Estherville has been president of the company; L. H. VanAlstine of Gilmore City, secretary, and former Governor B. F. Carroll was a member of the board of directors.—*Emmetsburg (Iowa) Democrat.*

Olympic Portland Cement Company to Increase Capacity

WORK has been started for enlargements and new installations at the Bellingham, Wash., plant of the Olympic Portland Cement Co. of Seattle, Wash. It is planned to install a new steel kiln 170 ft. in length and from 9 to 10 ft. diameter. This is expected to increase the plant output by 50% or to about 3000 bbl. per day. The kiln will be connected with a stack 170 ft. high, which is the same height as the other two stacks. The plant building will be widened 50%, a contingency that was provided for in the original plans. The estimated cost of the improvements which include enlargement, kiln and auxiliary machinery is expected to be about $350,000. Operation of the new kiln will probably begin in early 1926.

The Olympic Portland Cement Co. began operating at Bellingham in May, 1913. The original factory cost about $2,000,000. A wet process is used in the manufacture of cement and three shifts are employed, giving work to 160 men, including those at the Balfour quarries and the Brennan clay pits. The company has operated steadily throughout 1925 and plans to continue activity until the holidays. The plant output finds a market on the Pacific Coast, although some foreign shipments have been made, usually to Hawaii. —*Bellingham (Wash.) Herald.*

Monolith Makes Long Lease on Tehachapi Deposits

INVOLVING payment of a minimum of $4,520,000 in royalties during the terms of a lease for 100 years upon Tehachapi limestone and clay deposits, the I. M. Jameson Corporation has given the Monolith Portland Cement Co., of Los Angeles, the exclusive right to quarry limestone and clay and other materials to be used in cement manufacturing from land described as the southwest quarter 14 and section 13, 32-33, near Bakersfield, Calif. The agreement was filed for record recently.

Under the terms the cement company is to pay a royalty of 5 cents a barrel on cement manufactured, but the minimum royalties in any one month shall not be less than $3750. In consideration of $5000 cash payment all buildings on sections 13 and 14 were assigned to the cement company.

The Jameson interests also acquired title to the holdings of the cement company in the area lying south of the Southern Pacific right-of-way and east of the center of sections 31 and 32, 32-34. The Monolith company manufactures a waterprof, plastic cement that is much used on the Pacific Coast. —*Fresno (Calif.) Republican.*

New Director of United States Bureau of Mines

SCOTT TURNER, of Lansing, Mich., has been selected for the directorship of the U. S. Bureau of Mines. As Congress is not in session, he has been given a recess appointment by President Coolidge. He is expected to assume his new duties December 1. Dr. Dorsey Bain of the Bureau had been acting as director following the resignation of Director Bain. It is known that he had no desire to succeed to the administrative office but would rather carry on his extensive research program that he has in progress, consequently the appointment of an outside man to the directorship is not aimed to reflect on his ability and that of the men in the Bureau.

The appointment of Mr. Turner was made on the unanimous recommendation of the Advisory Committee from the mining industry recently appointed by Secretary Hoover and composed of representatives of the American Institute of Mining and Metallurgical Engineers, the American Mining Congress, the National Coal Association, the United Mine Workers, and the American Petroleum Institute. He was chosen from a list of over 20 men who were under consideration by the Advisory Committee.

Virginia Portland Cement Company Plant Ready to Operate

ACCORDING to a report from a Norfolk, Va., newspaper the new plant erected by the Virginia Portland Cement Co. at South Norfolk, Va., is expected to begin operations within a short time. First movements of raw material have already begun, preliminary to the firing of the first kiln. Clay is obtained from the company pits and marl from Chuckatuck deposits which are operated under contract by the W. F. Carey Co., Inc., of New York and who deliver the marl on barges to the plant.

The plant is a 3-kiln operation capable of turning out 1,000,000 bbl. per year, with an operating force of about 150 men. The second and third kilns, according to H. E. Hilts, manager of the plant, will be ready to operate about two weeks after the first is fired. The company is a subsidiary of the International Cement Co., of New York.

Concrete, Plain and Reinforced

THE fourth edition of "Concrete Plain and Reinforced," (Vol. I) by Taylor and Thompson, is disappointing in that the chapter on making concrete quite ignores all that has been found out about the design of concrete mixtures since the first edition was published. Surely the design of the mixture is as important as the design of the structural elements, such as beams and columns, since the strength of these depends primarily upon the strength of the concrete of which they are made.

That (other things being equal) the strength of concrete is entirely dependent upon the water-cement ratio is not even mentioned, although there is a caution against the use of too much water. The proper time of mixing is stated as "not less than ¾ minute," while from a minute to a minute and a half is required by various highway authorities and even the longer period is not long enough for some aggregates. Variations in strength are stated to be obtained by "proper proportioning of the cement and grading of the aggregates," which is true only insofar as these affect the water-cement ratio.

Finally, limestone is put in third place as an aggregate for fire-resisting qualities, whereas tests by the Underwriters' board and other bodies have shown conclusively that limestone stands first in this regard.

A second volume is promised and from the references made in Vol. I, which is reviewed here, it seems probable that a part of it may be devoted to the making of concrete. It is to be hoped that it will contain at least the information that is so easily available from publications of the Lewis Institute Bulletins, the pamphlets which are issued by the Portland Cement Association and the hundreds of magazine articles that have appeared in engineering magazines on both sides of the Atlantic.

Review of Florida Rock Products Industries

J. R. Thoenen Writes a Letter Preliminary to Series He Is Preparing for Rock Products

J. R. THOENEN, whose articles in ROCK PRODUCTS on the underground mining of limestone and gypsum in the United States have aroused so much interest, has been in Florida for ROCK PRODUCTS studying the various non-metallic industries and writing about them. There are only a few persons so qualified to study and write of these as Mr. Thoenen, who has had a mining engineers' training and experience and has in addition to this devoted the greater part of his working years to the investigation and development of deposits of limestone, gypsum, phosphate rock and other non-metallic minerals. Until recently he has been with the Bureau of Mines investigating underground methods.

The first of Mr. Thoenen's articles is to appear in an early issue. The letter which follows is a brief survey of the various industries as he found them during his trip.

DEAR MR. ROCKWOOD

I have just returned from a swing through the phosphate and limestone sections of central Florida. I find there are two distinct limestone formations which are worked for crushed stone. The first or soft Ocala limestone is quarried most extensively, and I have visited a number of operations around Williston and Ocala. This stone is a soft white, chalk-like stone used for the sub-grade in road construction. On top of this is placed a sheet of crushed slag or hard limestone with asphalt, making a fairly satisfactory road. Around Brookville there are two or three companies who quarry the Tampa limestone which is considerably harder than the Ocala and is more dolomitic in character. This stone is suitable for concrete aggregate and is quarried for such purpose. It requires thorough washing, however, to eliminate the clay matrix in which the Tampa limestone occurs as boulders ranging in size from that of a pea to several feet in diameter. There is a third kind of crushed stone being marketed known as flint, which is found as nodules in the Ocala limestone. Some plants separate this and sell it as concrete aggregate and as road surface stone. These flint nodules do not occur regularly throughout the Ocala limestone, but in beds, or rather pockets, hence a deposit may be quite free from flint. Some plants simply discard it as waste. All of these deposits can be worked only to water level, which is comparatively close to the surface.

At several points a high grade pottery clay is being mined from pits located below water level. The extraction is by means of dredges after removal of overburden by hydraulic giants. The washing of the clay results in the accumulation of large amounts of clean white sand, which is flushed to worked out parts of the deposit. This sand is in some cases recovered and sold as raw material for sand lime brick plants and concrete sand. It makes a very nice appearing brick, owing to its pure white color.

Among the phosphate mines I find only two operators working in the hard rock

J. R. Thoenen

fields, and they are producing only for export to European consumers. Recovery is by means of hydraulic stripping and dredging operations. Since the war, operators have gradually ceased operations owing to the high cost of extraction and the decreasing price for a marketable product.

In the land pebble field eight of the thirteen regular producers are operating at an increased rate over last year. Removal of overburden in this field is both by drag line and hydraulicking. All mining, however, is hydraulicking.

A comparatively new industry here is that of the recovery of a very clean white quartz sand from a few natural deposits. This sand after washing is clean, coarse and sharp and of excellent quality for concrete or cement products manufacture.

All industry is more or less retarded at the present time owing to the embargo on freight shipments into the state, due to the unprecedented influx of people from all parts of the country. Boom conditions apply everywhere with real estate offices as frequent as were once corner saloons. Hotels are full every night and sleeping quarters hard to locate. Cars are entering the state at the rate of one each minute of the daylight hours.

Several new cement plants are rumored to be proposed for immediate construction and plans are in preparation for the construction of new lime plants.

The impression one gets everywhere is that no matter how many quarries might be in operation their problem would be one of how to fill orders rather than how to get them.

J. R. THOENEN.

Daytona Soon to Get Rock Products

ORDERS for several train loads of building material have been placed by Daytona, Fla., builders and contractors to be filled as soon as the necessary permit is obtained from the Florida East Coast railway, was the recent statement of Frank A. Pierson, secretary of the chamber of commerce.

The chamber of commerce has been promised the permits, Mr. Pierson said, and will co-operate both with the railroad and the local builders and contractors in getting through materials needed to permit a continuation of the building program.

Among the firms that are desirous of moving solid train loads of material are the Bond-Howell Co., sixty cars of cement from a Tennessee shipping point, and the Highway Construction Co., a solid train load of slag from the Birmingham Slag Co., and a solid train load of gravel from Chattahoochee.

The Builders' and Contractors' Association, recently formed, can handle ten or more trainloads of materials, according to its officials, and will co-operate in making these up.

Under the plan proposed, the materials would be concentrated at a point north of Jacksonville, so as to permit freight movements direct to Daytona without further congesting the yards at Jacksonville.—*Jacksonville (Fla.) Times-Union.*

Beg Your Pardon!

THE EDITORS:

I have your letter of October 23 and I have noted your personal in your October 17 issue. I am sorry to say that I am not on my way to Alaska but have just returned.

(Signed) W. M. BEACH, *President,*
Pennsylvania Cement Co., New York.

Ontario Gypsum Company Pushing Completion of New Quebec Plant

WORK on the new Quebec branch plant in Montreal, East, for the Ontario Gypsum Co., Canada, which was started last July, is rapidly progressing. The plant buildings, two in number, are already completed. One of these is a one-story affair, 705 ft. long and the other is of two-story height, 160 ft. in length. A feature of the construction of these buildings is that they are said to be absolutely fireproof; the construction material being gypsum. In fact, the company is so sold on gypsum's fireproof qualities that they have placed no fire insurance on the entire plant, which, according to T. S. Robinson, superintendent, represents an investment of $500,000, with an additional $300,000 for machinery. The plant is located at Lakefield avenue, Montreal, East, near the Canada Cement Co. plant.

The plant products will be gyprock wall board, gypsum wall plasters, plaster of paris, and insules used in wall construction. Raw materials will be brought from Nova Scotia.

Louisville Cement Company to Build Near Akron

THE Louisville Cement Co. of Louisville, Ky., have recently purchased 144 acres of land at Newstead, N. Y., near Akron, on which it is planned to erect a plant for the production of Brixment. This plant, according to H. S. Gray, secretary-treasurer of the company, will be used to supply the Eastern market with the company product, Brixment, which is used chiefly as a non-staining mortar. It is expected that shipments from this plant will be made about May, 1926.

A New York state branch of the Louisville Cement Co. was incorporated under the laws of New York (see Oct. 17 issue) with a capital of $300,000. The directors are H. S. Gray, who is also secretary-treasurer of the present company, and M. C. and G. A. Bartholomew, Buffalo attorneys.

G. M. Basford Dies at New York

GEORGE M. BASFORD, railroad publicist and engineer and head of the G. M. Basford Co., 17 E. 42nd St., N. Y., dropped dead recently in a New York subway station.

Mr. Basford was a conspicuous figure in the transportation industry. He was best known in New York and abroad for his skill and success in influencing constant improvement in the design and utilization of the steam locomotive. In addition, Mr. Basford was known as the father of the Railway Signal Association, which now includes in its membership signal officers of every important railroad in North America, and as being responsible primarily for the activity of the railroads in the training of apprentices.

Mr. Basford was born in Boston in 1865 and attended public school there. He was graduated from the Massachusetts Institute of Technology in 1869, after which he entered the Charlestown shops of the Boston & Maine, later going to the Chicago, Burlington & Quincy as a draftsman at Aurora, Ill.

In September, 1905, Mr. Basford was made assistant to the president of the American Locomotive Co., and in March, 1913, became chief engineer of the railroad department of Joseph T. Ryerson & Son. Mr. Basford organized the G. M. Basford Co. to handle railway technical advertising in March, 1916.

Gravity Transportation at Hillhouse Quarry

THE EDITOR: I must compliment you on the excellent article and reproduction of views of our quarry which appeared in your October 3 issue. There is one correction that I must make, however, namely, the wagons from the quarry to the crusher are not drawn by horses but rather in the following way:

The wagons travel from the primary crusher and along the whole length of the quarry face by gravity and a 100 h.p. electric haulage is used to haul them up from the lowest point of the quarry, which, looking at the photo, is at the left end, to the primary crusher. The following brief abstract from a paper which I read before the quarry people at their conference last year will best explain the system.

"The Hillhouse quarry has adopted the continuous or circular railway system with the crusher situated at a point on the circle, and at a level which allows the wagons to travel by gravitation for three-fourths of the round journey, including the whole length of the quarry face. The wagon is stopped by the brake in front of the shovel wherever it may be at the time, and when loaded passes on and another takes its place. By this means, the whole operation of lifting and delivering 700 tons to the crusher in a normal working day can be carried on with about 9 men."

W. SHAW,
General Manager, Hillhouse Quarry Co.,
Troon, Scotland.
October 22, 1925.

Trade Association Research Activities

AMERICAN industry is saved annually approximately a half billion dollars through the conduct of laboratory research work, as shown in a bulletin on cooperative industrial research just issued by the Department of Manufacture of the Chamber of Commerce of the United States. The bulletin summarizes the research efforts of some eighty national trade associations, and estimates that American manufacturers expend about $35,000,000 annually in carrying them on.

"This sum," the bulletin specifies, "is not meant to imply that research is an inordinately expensive effort, but merely to indicate its importance as a trade association activity. Expenditures of individual trade organizations for research activities range from only a few hundred dollars to several hundred thousand dollars a year. The National Canners Association, for example, spends well over one hundred and twenty thousand dollars a year for research. The National Lime Association appropriates one hundred thousand dollars, the Portland Cement Association one hundred thousand dollars, the National Wood Chemical Association fifty thousand dollars, and so on down the line."

The department in its survey of research work found that the majority of trade associations spent more than twenty thousand dollars annually in carrying on this work.

In referring to the advantage gained from laboratory research, the department points out that "research or systematic investigation has so abolished rule o' thumb and guesswork from industry and business that definite specifications are now the rule.

"Heavy expense for laboratories and equipment limiting their availability to a few," the department explains, "has been overcome largely by the cooperative movement in many lines of industry through their trade associations. These joint efforts are of an unselfiish character involving as they do the common interests of all and are made primarily for the advancement of industry."

Copies of the bulletin may be had from the Chamber of Commerce of the United States, Washington, D. C.

France's Phosphate Wealth

FRANCE'S INTEREST in Morocco is not confined to fighting tribesmen. In a report to the American Section of the International Chamber of Commerce, Basil Miles, American Commissioner, points out that the greatest economic wealth of Morocco lies in its phosphate beds, covering an area of 750,000 acres, between Casablanca and the Zem river.

"The latest estimate of total deposits here," he says, "is 25,000 million tons. Other enormous beds to the south have also been discovered. The Kourigha beds are being directly exploited by the French Government through its Office National des Phosphates. The area now being developed (since 1921) is said to contain several million tons, and is located 90 miles from the port of Casablanca. In 1921 there were shipped 8,000 tons of these phosphates, 80,000 tons in 1922, in 1923 about 200,000 tons, and in 1924 over 400,000 tons. The total output for 1925 is expected to reach 600,000 tons. This is only a portion of the phosphates produced in French territory. France, with Alsace and her colonies, produces some 60% of the total world output, which was 7,000,000 tons last year."

Soil Laboratory Train in Western Ohio Gives Limestone Another Boost

WHEN nearly 1000 farmers brought samples of soil from 1500 fields to the traveling soil laboratory train in western Ohio recently and had them tested for acidity, the use of limestone for soil correction was given another boost. It was found after the three weeks' tour of this train was completed that 697 fields or 47% of those tested needed one or more tons of limestone to correct the acidity and make it possible to successfully grow alfalfa and sweet clover. The average limestone requirement was found to be slightly less than 2 tons per acre, contrary to the beliefs of the farmers in this district that their land needed any limestone at all. Tests on two soil samples from any one farm was the limit placed before the train started out and the final average indicated about 1½ samples per farm represented. In most cases the farmers brought samples from some field which they considered was "sick" and needed the attentions of the soil clinic and the "soil doctors" who accompanied the train.

The train covered 26 counties making 39 stops of a half-day each. Soils were tested by the chemists and specialists from the Soils Department, Ohio State University. Acidity, phosphorus content, organic matter and nitrogen content were the determinations made. As the farmer entered with his soil samples the samples were registered and given a number. Information was secured which developed the past methods of handling that particular soil and field together with the previous use of fertilizers and liming materials, if any. The extent of tile drainage was also noted on the blank form provided. The partially filled form was then taken by the farmer with the soil samples to the soil survey man from the Ohio experiment station who gave the farmer a brief discussion of the origin of the soil and put on the form, the soil type name and class as to its texture. The soils samples then started through the various processes of being tested while the farmer stood in front of the long laboratory table and watched the soil travel to the end and as each test was made the chemist in the long white coat placed the results on the form. When the form reached the end of the table and the testing was completed the crops specialist from the state university called the farmer's name and he stepped up for a discussion of the results of the tests and to give additional answers to questions about the past history of the particular field.

Following this, and the determination of what crops the farmer desired to grow on the land in the next four years, what kind of a rotation scheme he desired to practice, if any, the crops specialist would advise the best treatment for the land, which in his judgment would produce the best results. The largest returns per acre at the lowest possible cost was the ultimate aim of all the recommendations made. The best kind of liming material and its cost delivered at the station were supplied to the farmer. Ten samples of limestone from eight Ohio companies were on display. He was also given full information on fertilizers, their value and use. Plenty of opportunity was allowed for each man to ask questions so that when he left the car he had all the information it was possible to supply on his particular soil or crop problem.

Raw ground limestone is most generally used in western Ohio where any is used at all. Many farmers have found through this soil train that it will be greatly to their advantage to use limestone. They have found out how much to use for particular crops and for certain fields. Money will not be wasted but more limestone will be judiciously used with better results. This will encourage the greater use of limestone especially where legume crops are involved.

Soils being tested. Note the number of samples on the table in the special laboratory car

National Crushed Stone Association Convention

NATIONAL CRUSHED STONE ASSOCIATION is to hold its annual convention at the Mount Royal Hotel in Montreal, Que., January 18, 19, 20, 21. Make your reservations now, for space will be at a premium during this convention.

The progress of the industry in 1926 will be largely determined by the action of the convention. If you are a part of the industry it is to your interest to attend, not only to learn but to exercise your influence on the future course of the industry.

The usual exhibit of model machinery and equipment will be there, but bigger, better, and more complete than it has ever been before.

Hotel accommodations are the best. The usual social features will be better than ever this year.

Crushing Plant to Make Extensive Additions

THE Bluffton-Lewisburg Stone Co., of Bluffton, Ohio, have begun work on additions to their crushing plant to take care of the planned enlargement. The new machinery and construction will cost about $100,000 and are expected to almost treble the present plant capacity of 800 tons per day.

The principal addition to the mill will be a new electric motor-driven No. 30 McCullough crusher with a capacity of 2000 tons of stone daily. Three new screens will be added, one a revolving screen. The present building will be enlarged, raising its height from 67 to 82 ft.

Foundations for the additions have already been started. The crusher house will be 30 ft. square. The two new stone bins will be 64x16 ft. and 16x30 ft.

A new gasoline engine will also replace the 20-ton "dinky" and 5 cu. yd. cars will be installed together with another railroad siding.—*Bluffton (Ohio) Banner.*

Courses on Operation of Quarries and Gravel Plants

THE University of Michigan in a recent announcement of special professional short period courses in highway engineering has included one on the operation of quarries and sand and gravel plants to be conducted by Prof. Morrison of the University.

Nugent Sand Company Puts Large Barge in Service

ONE of the largest barges ever constructed for use on the Ohio river was launched recently by the Nugent Sand Co. of Louisville, Ky., at their docks.

The barge, which weighs 110 tons, is 102 ft. long and 26 ft. wide, having a capacity of 600 tons. All the timber is in one piece and is 8 in. thick. It will be used for hauling of sand and gravel on the Ohio river.

Construction of the barge was completed in two months and cost about $9000, according to William Nugent, president of the firm, who drew up the plans and superintended the work.

This is the seventh barge the company has built, all of which are now being used for hauling sand from Eight-Mile island to the company's pits. The barge was constructed on the banks of the Ohio river in the company's yards, which has 450 ft. fronting on the river. The firm is one of the oldest in Louisville.

Federal Road System of 50,000 Miles To Be Discussed at Good Roads Convention

THE perfection of a national highway system embracing 50,000 miles of improved roads and connecting all the states and larger cities, preliminary steps toward which were taken at a recent conference of federal and state highway officials in Washington, will be one of the matters fully discussed at the convention and machinery exposition of the American Road Builders' Association to be held in Chicago, January 11-15, next. The new national highway system is to be perfected by the government in conjunction with the states through federal aid. The routes will be marked and operated by the states.

State Geologists Hold Annual Meeting

THE annual fall field meeting of the Association of American State Geologists was held recently in eastern Pennsylvania, the Pennsylvania Geological Survey acting as host. Early arrivals were entertained at the homes of Dr. George H. Ashley and Mr. R. W. Stone. Four days were spent in the vicinity of Harrisburg, Hummelstown, Cornwall, Port Clinton, Pottsville, Mahanoy, Hazeltown, Mauch Chunk, Lehigh Gap, Slatedale, North Hampton, and Nazareth in observing the excellent exposures of the stratigraphy and structure, in observing the remarkable peneplain remnants, and in reviewing the mineral resouces of that part of the state, including the southern anthracite field, the slate area, brownstone quarries, cement plants, and the Cornwall magnetite mine. Evenings were devoted to discussions of matters pertaining to state survey policies and activities and to discussions of the geological problems of the areas covered. The state geologists were accompanied by a number of guests, including Doctor W. C. Mendenhall, chief, Messrs. E. O. Ulrich, Charles H. Butts, G. W. Stose, and Miss Jonas, all of the U. S. Geological Survey, Dr. David White, chairman of the Division of Geology and Geography and Dr. Albert L. Barrows, chairman of the Division of States Relations, National Research Council, Professor W. H. Bucher of the University of Cincinnati, Professor B. L. Miller of Lehigh University, Judge James R. McFarlane of the Court of Common Pleas, Pittsburgh, and members of the Pennsylvania Geological Survey. The following State Geologists represented their respective surveys: George H. Ashley, Herman Gunter, H. B. Kummel, M. M. Leighton, Raymond Moore, Wilbur A. Nelson, and David Reger (representing I. C. White). The meeting closed at Bethlehem, Penn., with a dinner at the Hotel Bethlehem, at which President Richards of Lehigh University and a number of the faculty were present.

National Sand and Gravel Association Convention

THE Tenth Annual Convention of the National Sand and Gravel Association will be held at the new Atlanta Biltmore hotel, in Atlanta, Ga., January 21 and 22. Reservations should be made early.

The National Sand and Gravel Association has made a wonderful growth, not only in membership but in the undertaking of new kinds of work for the benefit of member companies. This insures that the convention will be of even greater interest and importance than ever before.

Atlanta is a pleasant city and the hotel in which the convention will be held is one of the best in the United States. All sand and gravel producers are welcome whether members of the association or not.

Phosphate Industry of Nauru and Ocean Islands Active

RECORD phosphate shipments (471,000 tons) were made from Nauru and Ocean Islands during the year ended June 30, 1925. They were consigned as follows: New Zealand, 99,000 tons; Australia, 337,000 tons; foreign countries, 35,000 tons. Since assuming administration in 1920 the British Phosphate Co. has shipped 1,962,000 tons of phosphates—364,000 tons in 1920-21; 361,000 in 1921-22; 314,000 in 1922-23; 452,000 in 1923-24; and 471,000 in 1924-25. (Trade Commissioner E. G. Babbitt, Sydney, Australia.)

Change in Management in Wilson Sand Company

RETIREMENT of Charles R. Wilson from the Wilson Sand and Supply Co., Huntington, W. Va., and assumption of the vice-presidency of the company by A. B. Rawn, of that city was announced recently.

Mr. Rawn will assume active management of the company on December 1, although his interest in the Wilson firm will date from November 1.

Transfer of the interests of Mr. Wilson to Mr. Rawn involves about $600,000, as Mr. Wilson was the owner of three-fifths of all the stock in the company.

Mr. Rawn will retire from his position as vice-president and general manager of the Kingston and Pocahontas Coal Co.

The company Mr. Rawn takes over is capitalized at $1,000,000 and has two plants near Huntington, one at Alum Creek and one at Kenova, W. Va., on the Norfolk and Western railway, the latter known as the Kenova Sand and Gravel Co. The firm also owns the Ashland Sand and Gravel Co., of Ashland, Ky., on the C. & O. railway. The plant at Huntington is practically all steel and ranks among the best equipped in the sand industry.

The company also owns a fleet of tow boats and barges on the river, including the John T. Wilson and the Charles R. Wilson.

It is said that the company will not change its name or business policy. G. A. Northcott is expected to continue as president of the company.—*Huntington (W. Va.) Herald.*

Crescent Silica Sand Company Sold

THE plant and all real estate of the Crescent Silica Sand Co., Ottawa, Ill., have been purchased by the Standard Silica Sand Co., of Chicago, Ill., it was announced by A. C. Goodnow of Chicago, vice-president of the Standard company.

It is the plan of the Standard Co. to equip the Crescent with new machinery as soon as the plant is taken over, and it will be operated as a separate unit, under the management of F. D. Chadwick, who has been superintendent of the Standard's plant at Ottawa for a good many years.

The Crescent plant was built about two years ago by a company headed by Carl M. Gottfried of Chicago. It was operated but a short time, and closed down several months ago.

The Standard company by this deal becomes the owner of 80 acres of sand land west of the city, and by operating the plant as one of two units the company will have here it is expected that the overhead expense will be cut materially.

In accordance with the terms of the contract entered into by the Standard and Crescent officials the Standard will take over the Crescent property December 1. It is understood that the Crescent corporation will be dissolved.—*Ottawa (Ill.) Times.*

Traffic and Transportation

By EDWIN BROOKER, Consulting Transportation and Traffic Expert
Munsey Building, Washington, D. C.

Proposed Changes in Rates

THE following are the latest proposed changes in freight rates up to the week beginning November 11:

Southwestern Freight Bureau Docket

6149. Crushed marble. From Colorado points to Oklahoma points. To establish a rate of 34½ cents per 100 lb. on crushed marble, carloads, minimum weight 50,000 lb. from Colorado common points to Oklahoma points. Shippers request the publication of the same rate to Oklahoma points as is in effect to Texas common points.

6189. Chatts, gravel, etc., from White Stone, Tex., to Tulsa, Okla. To establish a rate of 16½ cents per 100 lb. on chatts, gravel, rock, common, crushed or ground; sand, shale; stone or granite natural, rough (not dressed or sawed); in straight or mixed carloads, minimum weight 50,000 lb., from White Stone, Texas, to Tulsa, Okla. Proposed rate is necessary from White Stone, Tex., to Tulsa in order to enable shippers to meet competition from points on other lines, shipments moving under the mileage scale of rates published in Item 4103-A in the above tariff.

6198. Lime. From points in Arkansas to points in Oklahoma. To establish rates on lime, carloads, minimum weight 30,000 lb., from Limedale Spur and Ruddells, Ark., to points in Oklahoma on the M. K. T. R. R. based 1½ cents per 100 lb. higher than the rates at present in effect from Springfield, Mo. It is stated that the present rates are the St. Louis Territorial rates and shippers advise that they are unable to move any traffic on this basis in view of rates in effect from Springfield, Mo.

6199. Lime. From points in Arkansas to points in Oklahoma. To establish rates on lime, carloads, minimum weight 30,000 lb., from Limedale Spur and Ruddels, Ark., to points in Oklahoma on the St. L. S. F. Ry., based 1½ cents per 100 lb. higher than the rates at present in effect from Springfield, Mo. Shippers contend that the St. Louis Territorial rates which are the present rates are prohibitive and prevent any movement in competition with rates in effect from Springfield, Mo., and other producing points.

New England Freight Association Docket

9126. Sand and gravel. Minimum weight 90% of the marked capacity of car except when car is loaded to cubical or visible capacity actual weight will apply, from Maynard, Mass., to Munroe Bridge, Mass., sand $1.65, gravel $1.75 per net ton. Reason—to permit movement of traffic.

9142. Granite and stone, N. O. I. B. N. (artificial or natural) blocks, slabs or pieces, rough quarried, sawed, hammered, chiseled, or dressed (not polished) from Boston, Mass., and stations on the Boston & Albany R. R. located in the Boston switching district, to Springfield, Mass., 16½, via B. & A. R. R. to include switching charge of the N. Y. N. H. & H. R. R. at Springfield, Mass. Reason—To meet competition.

9143. Limestone. Minimum weight 50,000 lb., from Cheshire, Farnams, North Adams, Renfrew, Richmond and Zylonite, Mass., to Harrisburg and Philadelphia, Penn., 22. Reason—To place the rate on limestone on a comparable basis with the rates applicable on lime.

9145. To establish an exception to the Official Classification on granite and stone N. O. I. B. N. (artificial or natural) blocks, slabs or pieces, rough quarried, sawed, hammered, chiseled or dressed (not polished), to apply locally between all stations on the Boston & Albany R. R. Proposed classification—Sixth class rate except when the sixth class rate exceeds 20 cents, the rate will be 20 cents per 100 lb. Reason—To meet competition and apply same basis as the N. Y. N. H. & H. R. R.

9146. Building granite, sawed, hammered, chiseled or dressed, not including polished granite, to Springfield, Mass., from Redstone, N. H., 19½; North Jay, Me., 20½. Reason—To establish commodity rates comparable with rates currently effective from contiguous territory.

9153. Sand, molding. Minimum weight 90% of the marked capacity of the car furnished from Rhinecliff, N. Y., to Worcester, Mass., 14½ cents to include B. & M. R. R. switching charges at Worcester, Mass. Reason—To meet rate of competing lines.

Southern Freight Association Docket

23510. Stone, crushed and powdered whitestone. Carloads, minimum weight 40,000 lb., from Whitestone, Ga., to Blacksburg, Va. Proposed, $4.30 per net ton made 70 cents per ton higher than the rate to Roanoke, Va. Present rate, $4.50 per net ton. (Roanoke combination.)

23526. Stone or marble, crushed. It is proposed to establish the same rates on stone or marble, crushed carloads, minimum weight capacity of car, but not less than 60,000 lbs., carloads, from Tate, Ga., to all points in Carolina territory shown in Agt. Glenn's I. C. C. A457 the same as the commodity rates from Whitestone, Ga., on stone or slate, crushed, carloads. At present, combination rates apply.

23552. Bituminous rock. With view of establishing a uniform description, it is proposed to publish the following description in connection with rates from, to and between points in the Southern Freight Association Territory:

Bituminous rock, crushed or ground. Carloads, minimum weight 80,000 lb., except when for carriers' convenience, car of less capacity is furnished, in which event marked capacity of car, but not less than actual weight will govern (in such instances, bills should carry certificate over agent's signature "Car of greater capacity not available") but in no case less than 50,000 lb. The minimum weight will be charged for on each car when the actual amount loaded is less.

23590. Granite, marble or stone, polished or carved. Less than carload, from Elberton, Ga., to Jacksonville, Fla. Present rate, 79 cents per 100 lb. (4th class); proposed, 42½ cents per 100 lb., same as the present rate from Marietta, Ga.

23619. Granite and stone taking same descriptions and minimum weights as applicable from Charlotte, N. C., and Southern Ry. quarries in South Carolina to Martinsville, Ind., published in So. Ry. Trf. I. C. C. No. A-9583, from Charlotte, N. C., and all Southern Ry. quarries in South Carolina, to Mooresville, Ind. Lowest combination now applicable. It is proposed to establish same rates on granite and stone carloads, from the origin named to Mooresville, Ind., as in effect to Martinsville, Ind., published in So. Ry. I. C. C. A-9583.

23643. Marble. It is proposed to publish a through rate of $6.99 per net ton on marble, rough viz.: Rough quarried blocks, rough sawed, sand rubbed or slushed, carloads, minimum weight 40,000 lb., from Marietta, Ga., to Grand Rapids, Mich. The above suggested rate represents the present Elberton, Ga., combination.

23654. Limestone, agricultural ground or pulverized. Carloads, minimum weight 60,000 lb., from Mt. Pleasant, Tenn., to Jackson, Miss., and Charleston, $4.12 per net ton, same as rates suggested in Submittal No. 23404 from Gordonsburg, Tenn.

23658. Slag. Carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity, actual weight will govern from Alabama City, Attalia and Gadsden, Ala., to Atlanta, Ga., and Group. Present rate, $1.02 per net ton; proposed, $1.20 per net ton, based on the single line prescribed Georgia scale for shortest distance via routes over which the traffic moves.

23703. Marble, crushed, ground or pulverized. Carloads, minimum weight 60,000 lb., from Tate, Ga., to Scranton, Penn., and Hackensack, N. J. Present rates (subject to minimum weight of 40,000 lb.): To Scranton, Penn., in bags, $6.84; in bulk, $6.37 per net ton; to Hackensack, N. J., in bags, $7.24; in bulk, $6.77 per net ton. Proposed rates: To Scranton, $6.54, same as rate to New York, N. Y.; to Hackensack, $6.94 per net ton, made 40 cents per ton over the rate to New York.

23715. Sand and gravel straight or mixed. Carloads, minimum weight 90% of the marked capacity of car, except when cars are loaded to their visible capacity actual weight will govern, from Louisville and Ludlow, Ky., to Lexington, Ky. Present rate, $1.25. proposed, $1.04 per net ton, made on basis of mileage scale published in So. Ry. I. C. C. A-9895.

23718. Stone, viz.: Blocks or slabs, rough quarried, sawed, sand rubbed or slushed. Carloads, minimum weight 36,000 lb., from New Albany, Ind., when from beyond, to Forest City and Rutherfordton, N. C. It is proposed to establish proportional rate equal to the Applachia, Va., combination, i. e., 24½ cents per 100 lb.

23719. Sand, Carloads, minimum weight 90% of stenciled capacity of car from Little Rover, Ala., to Gadsden, Ala. No specific commodity rate in effect. Proposed, 55 cents per net ton, made with relation to rate in effect from Benjamin, Ala.

Trunk Line Association Docket

13806. To cancel B. & O. R. R., I. C. C. 19398 publishing rate of $1.40 per ton on sand (other than blast, engine, foundry, glass, molding and silica) and gravel, carloads, and $1.51 per ton on sand, blast, engine, foundry, glass, moulding and silica, carloads, from Georgeton, N. C., to Torrison, Va., classification basis to apply. Reason for this proposal—There has been no recent movement of the above traffic and no prospect of any movement in the future. Therefore rates are obsolete.

Nebraska Cement Company Enters Rate Complaint

ALLEGING that $4.92 a ton instead of $4.30 was charged between June 1, 1923, and September 30 of that year for hauling cement materials from Colorado points to its plant at Superior, Neb., the Nebraska Cement Co. placed its complaint against the Burlington railroad before the interstate commerce commission examiner for Colorado.

J. H. Howell, examiner, took under consideration the company's request for reparations.—*Omaha (Neb.) World-Herald.*

Joint Rate Granted

LIME, plaster, stucco and so forth, from Irving and Blue Rapids, Kans., to points west of Salina on the Missouri Pacific will get a joint rate of 20½ cents per 100 lb. on a 30,000 lb. minimun carload, and 24 cents on a 40,000 lb. minimum, under a recent order issued by the public service commission on application of the Union Pacific and Missouri Pacific roads.—*Topeka (Kans.) Capital.*

Rates on Crushed Slate Discussed

THE Interstate Commerce Commission, by Division No. 3, in No. 15314, Lockport Paper Company vs. Maryland & Pennsylvania et al., mimeographed, found the combination rate of 30 cents, in effect between September 23, 1922, and September 10, 1923, on crushed slate, from Delta, Penn., to Lockport, N. Y., for movement via Buffalo, unreasonable to the extent it exceeded 20.5 cents and awarded reparation. It found the present rate of 17.5 cents not unreasonable or otherwise unlawful.

Commissioner Campbell, dissenting, said that, from a consideration of the Commission's decision in crushed stone from Maryland and Pennsylvania, 89 I. C. C. 681, he was convinced that a reasonable rate would have been about 17 cents for the past and for the future.—*Traffic World.*

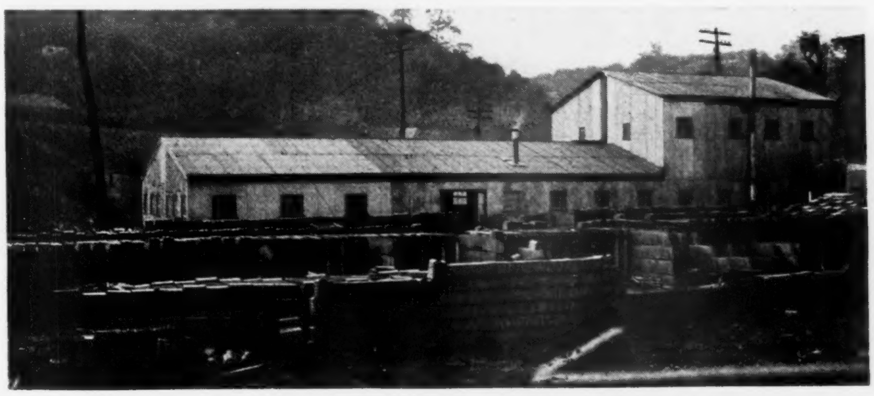
Cement Products

TRADE MARK REGISTERED WITH U. S. PATENT OFFICE

A Roofing Tile Plant That Works Overtime

Pittsburgh Hardware Dealer Adds Roofing Tile as a Side Line and Finds That the Demand Exceeds Plant Capacity

[The following story is from the Pittsburgh representative of the *Building Supply News* and it was published in the November 3 issue of that paper. It is reproduced here (including the cuts) through the courtesy of *Building Supply News*, as it is an excellent example of the way in which a concrete products business grows in a community in which building is steadily going on and where there is no unfair legislation to impede its growth.—The Editors.]



Concrete roofing tile plant of Hill's Hardware Co., Pittsburgh

THE South Hills Hardware Co. of Pittsburgh, Penn., has grown from a strictly hardware store to become the largest roofing concern in the city. It handles two lines of roofing—slate and concrete tile. The community was so vainly demanding both that Mr. Whitehead took them on. Of concrete tile he can't make enough to satisfy the rapidly accruing orders. Present space is limited but the plant will be soon moved to a new location and doubled in size.

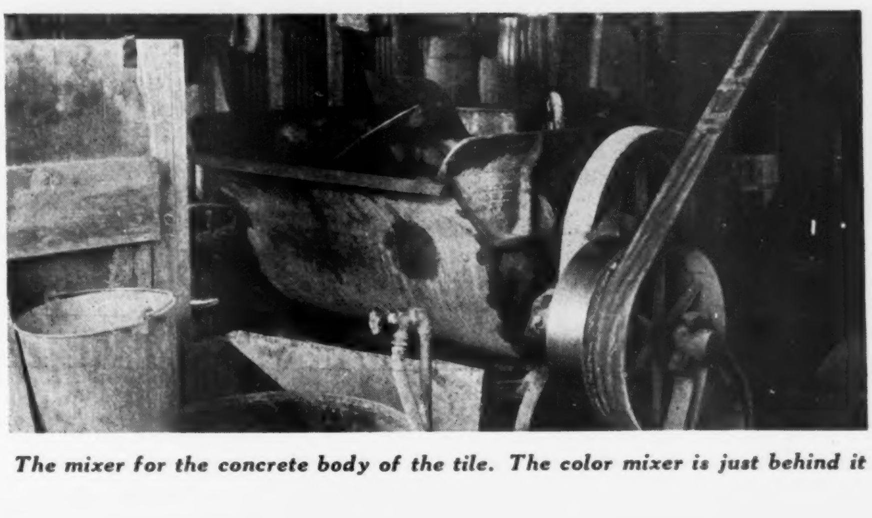
The process of manufacture is quite simple. And Mr. Whitehead has a power operated Hawthorne tile machine with concrete mixer and color mixer. The machine has a belt conveyor from machine to piling space inside the plant and two lift trucks for hauling tile out to yard storage space, where they are piled to cure for 30 days.

The plant's production is unusual, considering its size. This one electrically driven machine will turn out 6000 concrete roofing tile in a 9-hour day with 10 men working the plant. As each additional unit is put to work, the daily output will be expanded to just that much more for each new machine. And a small investment put the plant in operation. Mr. Whitehead has his eye on a large plant in the central west after which he intends patterning his new one.

Two striking colors of roofing tile are carried in stock at this plant—red and green. Other colors can be made to order. The colored concrete surface is applied to the upper surface of each tile immediately after it is molded by the power machine. In fact, the coloring process is a part of this ingenious mechanism. All special shapes, such as gable finials, ridge rolls, hip starters, etc., are made in addition to regular tile.

The method of laying the tile is as follows: A layer of waterproof paper is laid over the roof, after which wooden cleats, size 1x2 in., are laid in continuous strips horizontally, 12 in. apart, across the roof. Tile rest on these cleats, specially formed lugs on under side setting over the cleats with a firm grip. No nails are used except for ridge rolls, finials, hip starters, and other specials. Mr. Whitehead has several men employed who are skilled in laying concrete tile and he often quotes on a roof completely applied. He sells tile to roofers, though, just as he sells any other commodity which he carries in stock.

A portion of this tile plant has a second



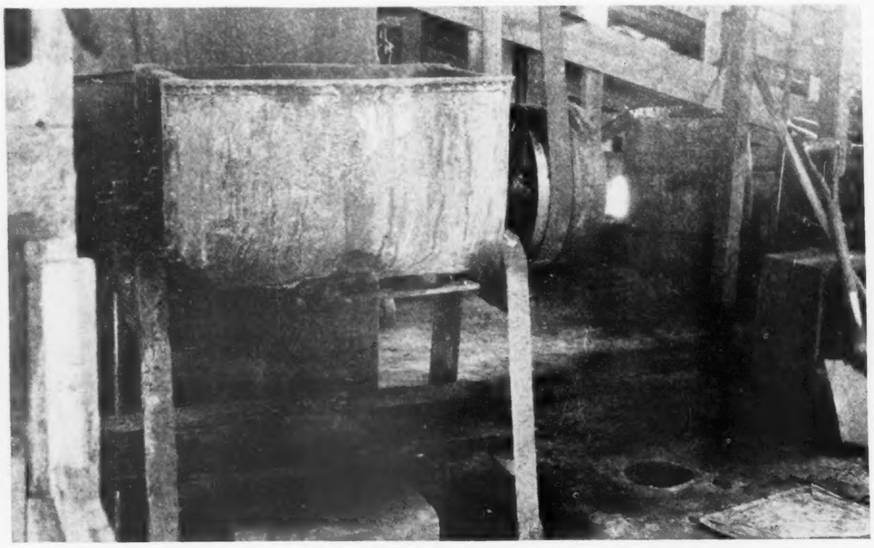
The mixer for the concrete body of the tile. The color mixer is just behind it

floor over the tile machine. A high embankment at that end makes it possible to back a motor truck through a large door in that wall of the building and dump its load of sand on the floor of the second story. The mixer stands close by.

For the body of tile a 3:1 mixture of sand to cement is used, mixed in a Blystone batch mixer to a damp semi-dry consistency. The mixer discharges into a chute, directly over the Hawthorne machine.

nine-hour day. The whole machine extends from floor to ceiling. In the base, of which is a steel frame table-high, are two endless chains running parallel about 24 in. apart. Connecting them are steel parallel cleats which move round with the chain. On these cleats the metal pallets are placed that hold the tile from the moment they are produced until hard enough next day to be stripped off.

One man attends the operation of machine while a second oils pallets with a solution of kerosene and tallow (about 5 lb. of tallow being added to a 25-gallon tank of oil), and places them one by one in position on the cleats between chains. A pallet is a pressed steel plate the exact size of a tile and is so shaped as to form the underside of tile with ridges and lugs, the latter being those which cling to wooden roof cleats.



The color mixer in which ground color and cement are mixed with sand and poured into the color container of the machine which is on the floor below

As each pallet moves under the chute from overhead hopper containing the concrete mixture for the body of tile a slide is opened which deposits the exact quantity of concrete required to make one tile on the pallet. Immediately following, the tile passes under an oscillating tamper of unusual design, shaped precisely like the surface of each tile with indentations corresponding to the ridges in metal pallet. The tamper is as long as the width of a tile and only about 3 in. wide. It vibrates at a point the exact thickness of tile above the pallet. As each tile passes under the tamper its surface is shaped as it appears in the finished product and is tamped at the same time.

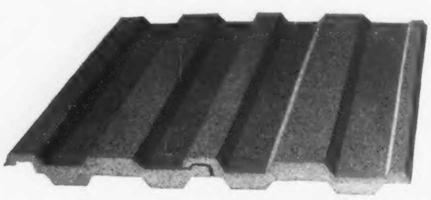
As quickly as tile are released from tamper, the color surface is spread on wet, through a slot from a color container above. The tile then is automatically shifted off the cleats onto a belt conveyor, which carries it down the center of plant, on each side of which is piling space for the product until it is stripped of pallets.

Tile are taken off by hand from the belt conveyor, which is run by an electric 2½ h.p. motor, and laid on racks on each side of belt conveyor until next morning, when the tile are hard enough to allow the pallets to be stripped off merely by tapping them. The tallow in the oil coating first put on them prevents any sticking.

As tile are stripped off pallets they are stacked on wooden platforms. These platforms stand about 10 in. above the floor on legs. When a platform rack is loaded with

More than ordinary care is exercised in preparing the surface coat for tile which contains the color. This is really a colored concrete mixture of portland cement, sand and green or red color with enough water to make it plastic. This is applied over tile immediately following molding, and becomes an integral part of each piece upon which it is applied.

Cement and color are ground together and thoroughly mixed dry in a pebble mill. For one hour the pebble mill revolves, grinding



The concrete roofing tile which is made at this plant

both color and cement together. For green, 14 lb. of chromium oxide is mixed with one bag of cement, while for red the proportion is 12½ lb. of red oxide to a sack of cement.

Following its grinding process, the color and cement mixture is put into a Day color mixer with water and sand to make a plastic composition of a molasses consistency. This is fed into a color agitator at the side of tile machine, where this coat is added to the product.

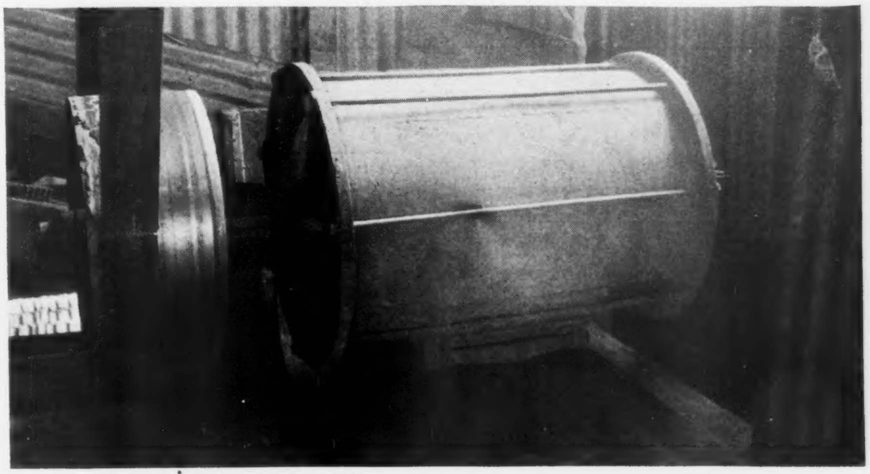
At the speed with which the tile making machine operates it turns out 6000 in a

The roofing tile machine used at this plant. The workman is setting one of the metal pallets

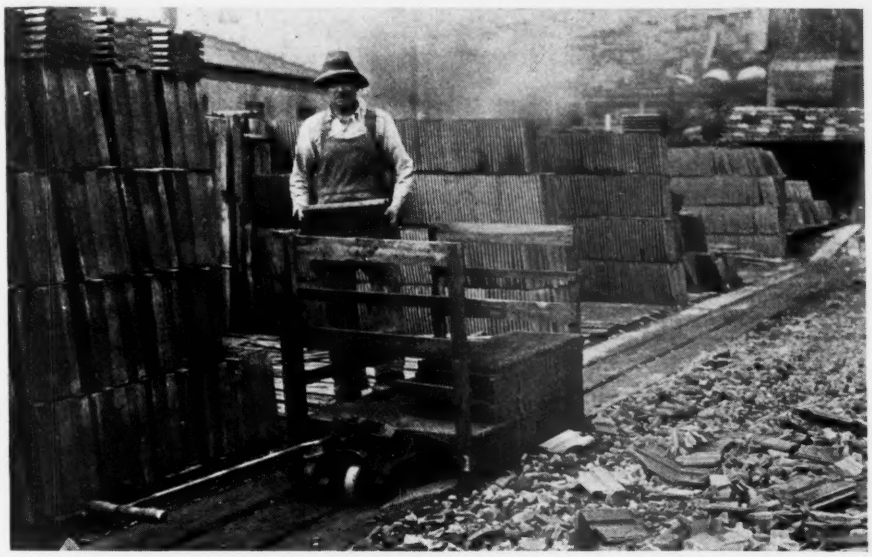
360 tile, a lift truck of the type shown is backed under and the load lifted high enough off floor so it can be pulled over to one side of the plant, where it is left. Tile are then sprayed with water for three to four days for further hardening before they are removed to outside storage.

In this plant also, as in many others throughout the country, the lift truck is daily proving its worth. It is a three-wheeled vehicle, setting close to the ground with a rising and lowering steel frame in the bed of it that lifts a platform rack holding 360 tile off the floor and holds it clear of the floor while a man pulls it anywhere it is intended to go.

After the spraying process, loaded racks are taken out into the yard and tile are piled on end in long stacks, where they remain for 30 days before being taken off and applied on roofs. Mr. Whitehead has experienced such a heavy demand that he has not been able to build up a reserve stcok. In fact, his organization at the plant has been working overtime regularly.



The pebble mill in which portland cement and color are thoroughly ground together before being put into the color mixer



Piling tile in the yard. Lifting trucks are used to move the tile in large quantities

For ridge and gable tile special shaped steel molds are used. The body is tamped down firmly and the whole shape made before the finish color is applied, thus completing the concrete tile. A metal pallet the exact form of the special shape also holds it until dry enough to be stripped off. In a 9-hour day one man can make 150 ridge rolls and about 10 hip starters.

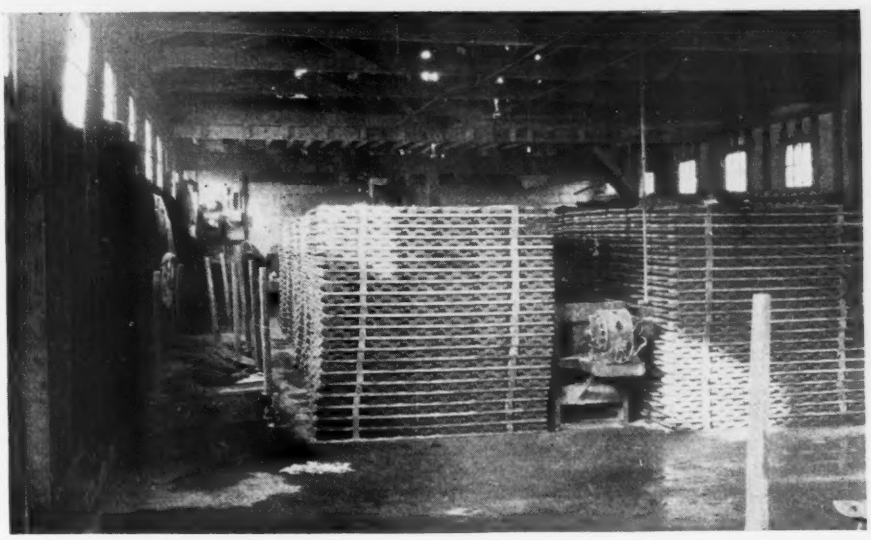
Convention of Concrete Products Manufacturers to Be Held in Cleveland, Ohio, January 27-29

THE annual national convention of the Concrete Products Association will be held in the Hotel Cleveland, Cleveland, Ohio, January 27, 28, 29, 1926. The special feature of this year's convention will be the discussion of sales promotion. Most of the papers to be read will deal with various phases of advertising and selling.

A tentative program has already been prepared with papers on "Personal Salesmanship," "The Plant as an Advertising Asset," "Circular Letter Advertising," "What to Do and What Not to Do in Newspaper Advertising," "Boosting Stucco to Help Block Sales," and "Fire Insurance Rates and Their Effect on Sales," to be among the discussions deemed suitable to this year's business.

The latest statistics available indicate that there are now some 10,000 manufacturers of concrete products in this country and Ohio alone has more than 800 manufacturing plants. This year's meeting is open to all manufacturers whether they are members of the association or not. It is expected that the central location of Cleveland will assure a large attendance with delegates coming from every state in the Union.

New officers for 1926 will be chosen at the meeting to succeed W. H. Carey, Wisconsin Rapids, president; S. I. Crew, Norwood, Ohio, and C. E. Lindsley, Irvington, N. J., vice-presidents; Bert Carey, Chicago, secretary, and Jacob Bosch, treasurer. These men were the officers for 1925. New directors of the association will also be chosen.



Interior of plant showing the tile racks and the belt conveyor between them which takes the tile from the machine to the racks. They are cured here by spraying before going to the yard

Current Market Prices of Cement Products

Concrete Block

Prices given are net per unit, f.o.b. plant or nearest shipping point

City of shipping point	Sizes 8x8x16	8x10x16	8x12x16
Camden and Trenton, N. J	....	.19‡	.30‡
Columbus, Ohio	.17@.19†	....	.27@29†
Detroit, Mich.	16.00*	....	25.00*
Forest Park, Ill.	18.00*	23.00*	30.00*
Graettinger, Iowa	.18@.20	....	....
Indianapolis, Ind.	.13@.15†	....	....
Los Angeles, Calif.	4x3½x12—.03;	6x3½x12—.04½;	8x3½x12—.05½
Oak Park, Ill.	.18@.21a	.23@.26a	....
Somerset, Pa.	.20@.22	....	....
Yakima, Wash.	22.50*	....	....

*Price per 100 at plant. †Rock or panel face. (a) Face. ‡ Delivered.

Concrete Brick

Prices given per 1000 brick, f.o.b. plant or nearest shipping point.

	Common	Face
Appleton, Minn.	20.00	25.00@35.00
Baltimore, Md. (Del. according to quantity)	15.50	22.00@50.00
Camden and Trenton, N. J.	17.00	
Ensley, Ala. ("Slag-tex")	14.50	22.50@33.50
Eugene, Ore.	25.00	35.00@75.00
Friesland, Wis.	22.00	32.00
Longview, Wash.	18.00	25.00@50.00
Milwaukee, Wis.	15.00	25.00@45.00
Mt. Pleasant, N. Y.		14.00@23.00
Omaha, Neb.	18.00	30.00@40.00
Pasadena, Calif.	12.50	
Philadelphia, Penn.	†15.25	‡21.50
Portland, Ore.	15.00@17.00	23.00@150.00
Prairie du Chien, Wis.	15.00	22.50
Rapid City, S. D.	18.00	25.00@45.00
Waco, Texas	16.50	32.50@125.00
Watertown, N. Y.	21.00	35.00
Wauwatosa, Wis.	14.00	20.00@42.00
Winnipeg, Man.	14.00	22.00
Yakima, Wash.	22.50	....

†Gray. ‡Red.

Current Prices Cement Pipe

Prices are net per foot f.o.b. cities or nearest shipping point in carload lots unless otherwise noted.

Culvert and Sewer	4 in.	6 in.	8 in.	10 in.	12 in.	15 in.	18 in.	20 in.	22 in.	24 in.	27 in.	30 in.	36 in.	42 in.	48 in.	54 in.	60 in.
Detroit, Mich.*	.13½	.20¼	.31½	.47¼	.60¾	1.08	1.62¼	1.95	2.60	2.92½	3.00	3.30	3.75	5.40	6.50	......	......
Graettinger, Iowa (drain tile)	......	.056	.075	.13	.175	.30	.50	.60	.80	1.00	......	1.60	......	......	......	......	......
Grand Rapids, Mich. (b)	......	......	......	.60	.72	1.00	1.28	......	......	1.92	2.32	3.00	4.00	......	......	......	......
Houston, Texas	......	.19	.24	.43	.55½	.90	.130	......	†1.70	2.20	......	......	......	......	......	......	......
Indianapolis, Ind. (a)	......	......	......	.80	.90	1.10	1.30	......	......	1.70	......	2.70	......	......	......	......	......
Longview, Wash.				Sewer pipe 40% off list, culvert—list													
Mankato, Minn. (b)	......	......	......	......	......	......	......	......	......	1.50	1.75	2.50	3.25	4.25	......	......	......
Mt. Pleasant, N. Y.	......	.17	.26	.39	.50	.68	.93	1.29	......	1.67	......	......	......	......	......	......	......
Norfolk, Nebr. (b)	......	......	......	.90	1.00	1.13	1.42	......	......	2.11	......	2.75	3.58	......	6.14	......	7.78
Paullina, Iowa‡	......	......	......	......	......	......	......	2.25	......	2.75	......	3.25	5.00	......	......	......	......
Tacoma, Wash.			4 in. to 18 in.			15 to 90 cents per foot			......								
Wahoo, Nebr. (b)	......	......	......	......	1.00	1.13	1.42	......	......	2.11	......	2.75	3.58	4.62	6.14	6.96	7.78
Waukesha, Wis.					4-in. to 24-in.—8.00 per ton												
Yakima, Wash.				$10.00 per ton													

*30-in. lengths up to 27-in. diam., 48-in. lengths after; (a) 24-in. lengths; (b) Reinforced; (c) Interlocking bar reinforced.
† 21-in. diam. ‡ Price per 2 ft. length.

Better Building Construction One of the Most Effective Ways to Fight Fire

ONE of the most important ways in which our tremendous annual fire loss (which now exceeds 500 million dollars) can be reduced is through better building construction, says Mr. S. H. Ingber, chief of the Fire Resistance Section of the Bureau of Standards, Department of Commerce. While this method of reducing fire losses necessarily takes some time in yielding apparent results, it is nevertheless, one of the most effective ways of combating this destructive element in the long run.

It is to be hoped that as old buildings are replaced, and as the new construction reflects to an increasing extent the knowledge gained in the laboratory and through studies of actual fires, the destruction of property will decrease.

The Bureau of Standards is carrying out many investigations with the object of improving the fire resistance of building materials and construction. Tests are being made on full-sized columns, walls, and partitions, using specially designed furnaces in which the temperatures encountered in a burning building can be duplicated. In this way the behavior of different kinds of construction and the value of all the commonly used building materials can be studied under accurately controlled conditions.

In order to find exactly what temperatures are reached in a burning building and how long a given temperature is maintained, the Bureau has constructed a special fire test house in which actual fires are "staged" from time to time. This small building is fitted up with discarded furniture and supplies to simulate any desired occupancy and is then set on fire and the necessary data secured. From the results of this work it has been possible to state just what temperatures ought to be in the experimental furnace.

Other tests have covered roofing materials, theater curtains, and office furnishings such as filing cabinets and safes. In the case of safes the fire test is followed by a drop test to simulate the rough treatment which a safe receives when the floor of the building collapses. If the safe withstands the drop test it is heated again in the furnace, as would be the case if it had fallen into the basement and was surrounded by burning material.

While these tests may seem destructive on first consideration, they are in reality one of the most constructive lines of work now in progress at the Bureau.

Texas Cement Products Plant Is to Double Its Capacity

WORK is expected to start soon on the construction of a $50,000 plant for the Cement Supply Co. of Beaumont, Texas, on a site adjoining their present plant. The new site is 220 by 480 ft. and will be connected by spur track to the Gulf Coast lines. Included in the plans for the new plant are the erection of sand bins, curing sheds, storage rooms and buildings for housing the machinery. Present plant output is expected to be doubled by this addition and about 20 more men will be employed to operate it.

The Cement Supply Co. was established about 5 years ago by W. B. Landes who is still the head of the concern. The plant at present produces cement roofing tile, garden furniture, cement specialties and novelties. The new plant will be devoted to making cement building products such as cement block, pipe in all sizes, hollow tile, etc. Operation is expected to start within a few months.—*Beaumont (Tex.) Journal.*

[Other prices relating to cement products—cement and aggregate—will be found with the regular current prices, pages 84 to 87.]

Henry Ford Finds Service, Not Dividends, Best in Business

The following account of an interview with Henry Ford at Seal Harbor, Me., September 17, is from the New York *Times:*

Henry Ford in an interview at his summer home here today prophesied that the country is in for 100 years of prosperity. Times are good, he declares, and will be even better.

"The thing we must bear in mind," he continued, "is service. Service—that's the thing. We should give service. The individual should give it in work; organizations should give service. Service brings prosperity.

"Making money isn't important. The important thing is to give service. Then you can't help making money.

"The trouble is there are too many heads of organizations who try to screw down wages and wring dividends out of the business. They want to get a lot of money and retire.

"Men should not retire. I haven't retired. The thing to do is to keep on working. And a man should not consider his business as a dividend producer. Any man who thinks more of dividends than he does of service and the welfare of persons who work for him is a poor business man.

"His business will not survive long. It can't. He may think it can, but he is fooling himself. Such a man hurts a business.

"I believe in good wages. I pay them. It makes prosperity. If you don't pay good wages you hurt yourself."

The Danger of Bad Air in Old Wells and Other Openings

WARNING against entering any place where the air does not circulate unless one is first assured that it contains enough oxygen to support life is given by Dr. Thomas T. Read, safety service director of the Bureau of Mines, Department of Commerce, in commenting on the recent death of three persons who entered a well near Rockwood, Md., to make repairs to the piping. Wells, abandoned mines and other confined spaces where the air does not circulate may be filled with black damp, and the incautious person who ventures into them may be asphyxiated. Black damp is a miner's term for air that has become depleted of its oxygen and consists mainly of nitrogen and carbon dioxide. It is not poisonous, but, being heavier than ordinary air, it lies in a confined space like so much water and a person who goes into it is as effectually cut off from the life-supporting oxygen as if he had gone under water. Unless immediately rescued, he will die as quickly as he would by drowning.

Such accidents are much more common than is generally supposed, Dr. Read continues. Not long ago, one of two men who were strolling near Summerville, Ala., walked a few yards into the slope of an abandoned mine. His companion saw him fall and, instead of immediately trying to rescue him, ran to a nearby house for help. By the time help was obtained the man was dead. Last autumn a boy delivering bread for a bakery stopped at an abandoned mine, near a highway between Culbertson and Froid, Mont., and climbed down the ladderway. He was overcome by black damp, another boy who tried to rescue him was also overcome and by the time help reached them both were dead. Many other similar cases might be cited.

Such deaths could be avoided if people would not enter abandoned mines, wells and such places unless they have some definite duty to perform there, it is pointed out. If it is necessary to enter a place of this description, it is very easy to test for the presence of black damp by lowering a lantern to the point at which it is desired to go. If the lantern goes out, black damp is present and should be removed before entering. In the case of a well, an opened umbrella can be used to bail it out, like bailing water out in a bucket, or a current of air may be set up by any convenient means. But do not enter until the lantern burns without flickering, after which it will be safe. The observance of these simple precautions, the Bureau of Mines considers, would save a number of lives annually.

Winter Construction on the Increase

THE building season is gradually being lengthened as the result of a drive undertaken by the construction industries in co-operation with the Department of Commerce. This fact has been established through a survey made by the Division of Building and Housing of the department at the direction of Secretary Hoover to determine what results were being obtained. Reports from contractors in 16 large cities show that payrolls and material purchases were relatively larger in the winter months of 1924 than in those of 1923. The 1923 figures in turn showed an increase over 1922.

Practically all replies from contractors had the same trend, making an average a fair statement of conditions as given. Changes in general business conditions and a difference in the weather undoubtedly had some share in the result. But making allowance for such factors, a distinct improvement in the relative amount of winter building is apparent.

There are already favorable indications for the coming winter. The August figures for contracts awarded for all classes of constructions have proved to be the highest ever known. Many of the operations represented by these contracts will undoubtedly be carried over into the cold weather.

All groups in the building industry are trying earnestly to bring about a more equal distribution of work throughout the year.

Why Small Feldspar Mines Fail

THE point has been often brought up that the country was running short of feldspar. It has been also said that the main source of supply came from farmers and collected in centralized bins thus making it impossible for the grinders to produce a uniform feldspar. John W. Wilkes of the Eureka Flint and Spar Co., in an article in the *Ceramic Industry,* refutes these statements and gives the results of his 25 years in the feldspar business. He says:

"I have spent over 15 years prospecting for and developing feldspar deposits in the United States and Canada. This has convinced me that we are not running short of crude feldspar but just commencing to find it. I have found that most of the large grinders own, or have leased for long terms, large deposits from which they are getting uniform grades of feldspar for their mills. Most of the deposits near transportation are being worked out fast but back in the hills there is plenty. When you consider that the manufacturer must haul the crude feldspar from 5 to 20 miles over poor roads, ship it to his mills and grind it and then get from $16 to $21 per ton from the pottery trade, it is no wonder that little selecting is done."

"Dotting the country all around in producing states are hundreds of small excavations some of them 50 years old. Here and there are a few large ones, the result of proper development. The reason for this lies not in the fact that the "few" contained feldspar but because the "many" were started by men who didn't know what they were after. As an example, in a mine under my control, of the 12 men working there, five started quarrying operation themselves within a few months. This without any experience, capital or knowledge of the uses of spar."

"There is a large field for a mining engineer to specialize in feldspar mining. The industry demands it. Deposits are not always what they appear to be on the surface."

"The main thing to consider in looking for and mining feldspar is that it is easier to sell 20,000 tons from one large deposit than 50 to 100 tons from a small one. The demand from pottery works for uniform grades is the answer for this. This is also the reason for the grinders generally owning or controlling their deposits. Before undertaking the development of a prospect, it must be ascertained what the particular spar is good for. Certain trades demand the best. Smaller mines generally supply the glass and soap trade. It is also used for chicken grit, roofing gravel and stucco dash. The mining of the material is costly for these reasons; high wages, inaccessibility of deposits which require long hauls and the very few practical feldspar men about. There is plenty of feldspar left yet in New York, Connecticut, Maine, North Carolina, New Hampshire and Tennessee."

The Rock Products Market

Wholesale Prices of Crushed Stone

Prices given are per ton, F.O.B., at producing point or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:						
Buffalo, N. Y.	1.30	1.30	1.30	1.30	1.30	1.30
Chaumont, N. Y.	.50	.....	1.75	1.25	1.25	1.25
Cobleskill, N. Y.	1.50	1.35	1.25	1.25	.....	.....
Coldwater, N. Y.	All sizes at 1.40 per net ton					
Eastern Pennsylvania	1.35	1.35	1.35	1.35	1.35	1.35
Munns, N. Y.	1.00	1.50	1.50	1.40	1.40	.....
Northern New Jersey	1.60	1.50@1.80	1.30@2.00	1.40@1.60	1.40@1.60	.....
Prospect, N. Y.	1.00	1.40	1.40	1.30	1.30	.....
Walford, Penn.	1.00	1.30	.....	1.50h	1.50h	.....
Watertown, N. Y.	.50	.....	1.75	1.50	1.50	1.50
Western New York	.85	1.25	1.25	1.25	1.25	1.25
CENTRAL						
Alton, Ill.	1.75	.....	1.75	.....	.....	.....
Bloomville, Middlepoint, Dunkirk Bellevue, Waterville, No. Baltimore, Holland, Kenton, New Paris, Ohio; Monroe, Mich.; Huntington, Bluffton, Ind.	1.00	1.10	1.10	1.00	1.00	1.00
Buffalo and Linwood, Iowa	1.10	.....	1.20	1.00	1.05	1.05
Chasco, Ill.	.....	1.15	1.15	1.15	1.15	.....
Chicago, Ill.	.80	1.00	1.00	1.00	1.00	1.00
Columbia, Krause, Valmeyer, Ill.	1.00@1.50	1.20@1.25	1.20@1.25	1.20	1.20	1.50
	Flux all at 1.30					
Cypress, Ill.	1.15	1.15	1.15	1.15	1.05	1.00
Dundas, Ont.	.70	.90	.90	.90	.90	.90
Gary, Ill.	1.00	1.37½	1.37½	1.37½	1.37½	1.37½
Greencastle, Ind.	1.25	1.15	1.15	1.05	.95	.95
Lannon, Wis.	.80	1.00	1.00	.90	.90	.90
Northern New Jersey	1.30	.....	1.80	1.60	1.40	.....
River Rouge, Mich.	1.10	1.10	1.10	1.10	1.10	1.10
Sheboygan, Wis.	1.10	1.10	1.10	1.10	1.10	1.10
St. Vincent de Paul, Que.	.85	1.35	1.05	.95	.90	.90
Stone City, Iowa	.75	.....	1.10	1.05	1.00	.....
Toronto, Ont.	.....	1.95	1.80	1.80	1.80	.....
Waukesha, Wis.	.90	.90	.90	.90	.90	.90
Wisconsin Points	.50	.....	1.00@1.15	.90@1.05	.90@1.05	.....
SOUTHERN:						
Alderson, W. Va.	.50	1.60	1.60	1.50	1.40	.....
Allgood, Ala.	Crusher run, fines out, for flux, 1.00 per net ton					
Cartersville, Ga.	1.65	1.65	1.65	1.15	1.15	1.15
Chico, Texas	1.00	1.35	1.35	1.25	1.20	1.10
El Paso, Texas	1.00	1.10	1.10	1.10	.....	.....
Ft. Springs, W. Va.	.50	1.60	1.50	1.35	1.25	.....
Graystone, Ala.	Crusher run fluxing stone, 1.00 per net ton					
Henderson, N. C.	.....	.....	1.50	.....	1.25	.....
Olive Hill, Ky.	.50@1.00‡	1.00	1.00	1.00	1.00	1.00
Rockwood, Ala.	.90	.....	.....	.....	1.00	.90
Rocky Point, Va.	.50@1.00	1.40@1.60	1.30@1.40	1.15@1.35	1.10@1.20	1.00@1.05
WESTERN:						
Atkinson, Kans.	.25	2.00	2.00	2.00	2.00	1.60‖@1.80
Blue Springs & Wymore, Neb.	.25	1.45	1.45	1.35c	1.25d	1.20
Cape Girardeau, Mo.	1.25	.....	1.25	1.25	1.00	.....
Kansas City, Mo.	1.00	1.80	1.80	1.80	1.80	1.80
Kirkfield, Ontario	.70	1.05	.90	.90	.90	.90
Rock Hill, St. Louis Co., Mo.	1.25	1.25	1.25	1.25	1.25	1.35

Crushed Trap Rock

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Branford, Conn.	.60	1.70	1.45	1.20	1.05	.....
Duluth, Minn.	.90	2.25	1.90	1.50	1.35	1.35
Dwight, Calif.	1.00	1.00	1.00	.90	.90	.....
Eastern Maryland	1.00	1.60	1.60	1.50	1.35	1.35
Eastern Massachusetts	.85	1.75	1.75	1.25	1.25	1.25
Eastern New York	.75	1.25	1.25	1.25	1.25	1.25
Eastern Pennsylvania	1.10	1.70	1.60	1.50	1.35	1.35
Knippa, Texas	2.50	1.60@2.00	1.55	1.40@1.50	1.25@1.30	.....
New Haven, New Britain, Meriden & Wallingford, Conn.	.60	1.70	1.45	1.20	1.05	1.05
Northern New Jersey	1.50e	2.00	1.80	1.40	1.40	.....
Oakland and El Cerritto, Cal.	1.00	1.00	1.00	.90	.90	.....
San Diego, Calif.	.70e	1.80f	1.60	1.40g	1.30	.....
Sheboygan, Wis.	1.00	1.10	1.10	1.10	1.10	.....
Springfield, N. J.	1.70e	2.00	2.10	1.70	1.70	.....
Westfield, Mass.	.60	1.50	1.35	1.20	1.10	1.10

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Atlanta, Ga. (granite)	1.35	2.35	2.35	2.00	2.00	2.00
Berlin, Utley, Montello and Red Granite, Wis.—Granite	1.80	1.70	1.50	.....	1.40	.....
Coldwater, N. Y.—Dolomite	1.50 all sizes					
Columbia, S. C.—Granite	.50	1.75	1.75	.....	1.60	.....
Eastern Penn.—Quartzite	1.20	1.35	1.25	1.20	1.20	1.20
Havelock, Ontario	.....	2.60	2.10	2.10	.....	.....
Lithonia, Ga.	.75	1.75	1.60	1.25	1.25	.....
Lohrville, Wis.—Granite	1.65	1.70	1.65	1.45	1.50	.....
Middlebrook, Mo.—Granite	3.00@3.50	.....	2.00@2.25	2.00@2.25	.....	1.25@2.00
Northern New Jersey (Basalt)	1.50	2.00	1.80	1.40	1.40	.....
Richmond, Calif.—Quartzite	.75*	.....	1.50*	1.50*	1.50*	.....
Toccoa, Ga. (granite)	.50	.....	1.35@1.50	1.25@1.50	1.25@1.35	.....

*Cubic yd. †1 in. and less. ‡Two grades. ‖Rip rap per ton. (a) Sand. (b) to ¼ in. (c) 1 in., 1.40. (d) 2 in., 1.30. (e) Dust. (f) ¼ in. (h) less 10c discount. (i) 1 in., 1.40.

Agricultural Limestone

(Pulverized)

Alton, Ill.—Analysis 99% $CaCO_3$, 0.3% $MgCO_3$; 90% thru 100 mesh		4.00
Asheville, N. C.—Analysis, 57% $CaCO_3$, 39% $MgCO_3$; 50% thru 100 mesh; 200-lb. burlap bag, 4.00; bulk		2.75
Belfast and Rockland, Me. (rail), Lincolnville, Me. (water), analysis $CaCO_3$ 90.04%; $MgCO_3$ 1.5%, 100% thru 14 mesh, bags		4.50
Bulk		3.00
Branchton and Osborne, Penn.—100% thru 20 mesh; 60% thru 100 mesh; 45% thru 200 mesh. (Less 50 cents commission to dealers)		5.00
Cape Girardeau, Mo.—Analysis, 93% $CaCO_3$, 3.5% $MgCO_3$; pulverized; 50% thru 50 mesh		1.50
Cartersville, Ga.—Analysis 68% $CaCO_3$, 32% $MgCO_3$; pulverized		2.50
50% thru 50 mesh		2.00
Chaumont, N. Y.—Pulverized limestone, bags, 4.00; bulk		2.50
Colton, Calif.—Analysis 90% $CaCO_3$, bulk		4.00
Cypress, Ill.—90% thru 100 mesh		1.35
Danbury, Conn., Rockdale and West Stockbridge, Mass.—Analysis, 90% $CaCO_3$, 5% $MgCO_3$; 50% thru 100 mesh; paper bags, 4.75; cloth, 5.25; bulk		3.25
Dundas, Ont., Can.—Analysis, 53.80% $CaCO_3$, 43.31% $MgCO_3$; 35% thru 100 mesh, 50% thru 50 mesh, 100% thru 10 mesh; bags, 4.75; bulk		3.00
Henderson, N. C. (paving dust)—80% thru 200 mesh, bags	4.25@	4.75
Bulk	3.00@	3.50
Analysis $CaCO_3$, 56%; $MgCO_3$, 42%; 65% thru 200 mesh, bags		3.95
Bulk		2.70
Hillsville, Penn.—Analysis, 94% $CaCO_3$, 1.40% $MgCO_3$; 75% thru 100 mesh; sacked		5.00
Jamesville, N. Y.—Analysis, 89.25% $CaCO_3$; 5.25% $MgCO_3$; pulverized, bags, 4.00; bulk		2.50
Knoxville, Tenn.—Analysis, 52% $CaCO_3$, 37% $MgCO_3$; 80% thru 100 mesh; bags, 3.95; bulk		2.70
Linville Falls, N. C.—Analysis, 57% $CaCO_3$, 39% $MgCO_3$; 50% thru 100 mesh; 200-lb. burlap bag, 4.00; bulk		2.75
Marblehead, Ohio—Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$; 60% thru 100 mesh; 70% thru 50 mesh; 100% thru 10 mesh; 80 lb. paper sacks, 5.10; bulk		3.60
Marion, Va.—Analysis, 90% $CaCO_3$, pulverized, per ton		2.00
Mayville, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 90% thru 100 mesh	3.90@	4.50
Mountville, Va.—Analysis 76.60% $CaCO_3$, 22.83% $MgCO_3$; 100% thru 20 mesh—burlap bags		5.00
Piqua, Ohio—Total neutralizing power 95.3%; 99% thru 10, 60% thru 50; 50% thru 100	2.50@	2.75
100% thru 10, 90% thru 50, 80% thru 100; bags, 5.10; bulk		3.60
99% thru 100, 85% thru 200; bags, 7.00; bulk		5.50
Rocky Point, Va.—Analysis 99.5% $CaCO_3$, 0.25% $MgCO_3$; 50% thru 200 mesh; bags, 3.25@3.50; bulk	2.00@	2.25
Waukesha, Wis.—90% thru 100 mesh		4.50
Watertown, N. Y.—Analysis, 96-99% $CaCO_3$; 50% thru 100 mesh; bags, 4.00; bulk		2.50
West Rutland, Vt.—90% thru 100 mesh; 7.00 in bags; bulk		4.50

Agricultural Limestone

(Crushed)

Alton, Ill.—Analysis 99% $CaCO_3$, 0.3% $MgCO_3$; 90% thru 50 mesh, 6.00; 50% thru 4 mesh		4.00
Alderson, W. Va.—Analysis, 90% $CaCO_3$; 50% thru 100 mesh		1.50
Atlas, Ky.—Analysis over 90% $CaCO_3$; 90% thru 4 mesh	1.00@	2.00
Bedford, Ind.—Analysis, 98.5% $CaCO_3$, 0.5% $MgCO_3$; 90% thru 10 mesh		1.50
Bettendorf, Iowa—97% $CaCO_3$, 2% $MgCO_3$; 50% thru 100 mesh; 50% thru 4 mesh		1.50
Blackwater, Mo.—Analysis, 99% $CaCO_3$; 90% thru 4 mesh	.60@	1.00

(Continued on next page)

Agricultural Limestone

(Continued from preceding page)

Bridgeport and Chico, Texas—Analysis, 94% $CaCO_3$, 2% $MgCO_3$; 100% thru 10 mesh	1.75
50% thru 4 mesh	1.50
Chasco, Ill.—50% thru 100 mesh	1.20
Chico, Texas—90% thru 4 mesh; bulk	1.50
Chicago, Ill.—50% thru 100 mesh; 90% thru 4 mesh	.80
Columbia, Krause, Valmeyer, Ill.—Analysis, 90% $CaCO_3$; 90% thru 4 mesh	1.35
Cypress, Ill.—90% thru 50 mesh, 50% thru 100 mesh, 90% thru 50 mesh, 90% thru 4 mesh, 50% thru 4 mesh	1.35
Ft. Springs, W. Va.—Analysis, 90% $CaCO_3$; 90% thru 50 mesh	1.50
Garnet, Okla.—All sizes	1.25
Gary, Ill.—Analysis, approx. 60% $CaCO_3$, 40% $MgCO_3$; 90% thru 4 mesh	.75
Kansas City, Mo.—50% thru 100 mesh	1.00
Lannon, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 99% through 10 mesh; 46% through 60 mesh	2.00
Screenings (¼ in. to dust)	1.00
Marblehead, Ohio.—Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$, 32% thru 100 mesh; 51% thru 50 mesh; 83% thru 10 mesh; 100% thru 4 mesh (meal) bulk	1.60
Mayville, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 50% thru 50 mesh	1.85@ 2.35
Middlepoint, Bellevue, Kenton, Ohio; Monroe, Mich.; Huntington and Bluffton, Ind.—Analysis, 42% $CaCO_3$, 54% $MgCO_3$; meal, 25 to 45% thru 100 mesh	1.60
Milltown, Ind. — Analysis $CaCO_3$, 93.10%, 40% thru 50 mesh	1.35@ 1.60
Moline, Ill., and Bettendorf, Iowa—Analysis, 97% $CaCO_3$, 2% $MgCO_3$; 50% thru 100 mesh; 50% thru 4 mesh	1.50
Pixley, Mo.—Analysis, 96% $CaCO_3$; 50% thru 50 mesh	1.25
50% thru 100 mesh; 90% thru 50 mesh; 50% thru 50 mesh; 90% thru 4 mesh; 50% thru 4 mesh	1.65
River Rouge, Mich.—Analysis, 54% $CaCO_3$, 40% $MgCO_3$; bulk	.80@ 1.40
Stone City, Iowa. — Analysis, 98% $CaCO_3$; 50% thru 50 mesh	.75
Tulsa, Okla.—Analysis $CaCO_3$, 86.15%, 1.25% $MgCO_3$, all sizes	1.25
Waukesha, Wis.—Test, 107.38% bone dry, 100% thru 10 mesh; bags, 2.85; bulk	2.10

Pulverized Limestone for Coal Operators

Hillsville, Penn., sacks, 4.50; bulk	3.00
Piqua, Ohio, sacks, 4.50@5.00 bulk	3.00@ 3.50
Rocky Point, Va.—80% thru 200 mesh; bags	4.25@ 4.75
Waukesha, Wis.—90% thru 100 mesh, bulk	3.70

Miscellaneous Sands

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

Glass Sand:	
Berkeley Springs, W. Va.—Glass sand	2.25
Cedarville and S. Vineland, N. J.—Damp	1.75
Dry	2.25
Cheshire, Mass.: 6.00 to 7.00 per ton; bbl	2.50
Columbus, Ohio	1.25@ 1.50
Estill Springs and Sewanee, Tenn	1.50
Franklin, Penn.	2.00
Gray Summit and Klondike, Mo	2.00
Los Angeles, Calif.—Washed	5.00
Mapleton Depot, Penn	2.00@ 2.25
Massillon, Ohio	3.00
Mineral Ridge and Ohlton, Ohio	2.50
Oceanside, Calif.	3.00
Ottawa, Ill.—Chemical and mesh guaranteed	1.25
Pittsburgh, Penn.—Dry	4.00
Damp	3.00
Red Wing, Minn.: Bank run	1.50
Ridgway, Penn.	2.00
Rockwood, Mich.	2.75@ 3.25
Round Top, Md.	2.25
San Francisco, Calif.	4.00@ 5.00
St. Louis, Mo	2.00
Sewanee, Tenn.	1.50
Thayers, Penn.	2.50
Utica, Ill.	1.00@ 1.15
Zanesville, Ohio	2.50
Miscellaneous Sands:	
Aetna, Ind.: Core, Box cars, net, .35; open-top cars	.30
Albany, N. Y.: Molding coarse	2.00
Molding fine, brass molding	2.25
Sand blast	4.00

(Continued on next page)

Wholesale Prices of Sand and Gravel

Prices given are per ton, F.O.B., producing plant or nearest shipping point

Washed Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
EASTERN:						
Ambridge & So. H'g'ts, Penn.	1.25	1.25	1.15	.85	.85	.85
Attica and Franklinville, N. Y.	.75	.75	.85	.75	.75	.75
Buffalo, N. Y.	1.10	.95			.85	
Erie, Pa.		1.00*		1.50*	1.75*	
Farmingdale, N. J.	.58	.48	.75	1.25	1.10	
Hartford, Conn.	.65*					
Leeds Junction, Me.		.50	1.75		1.35	1.25
Machias Jct., N. Y.		.75	.75		.75	.75
Montoursville, Pa.	1.00	1.10	1.00	.75	.75	.75
Northern New Jersey	.50	.50	1.25	1.25	1.25	
Olean, N. Y.		.75	.75	.75	.75	.75
Shining Point, Penn.			1.00	1.00	1.00	1.00
South Heights, Penn.	1.25	1.25	.85	.85	.85	.85
Washington, D. C.	.85	.85	1.70	1.50	1.30	1.30
CENTRAL:						
Algonquin and Beloit, Wis.	.50	.40	.60	.60	.60	.60
Attica, Ind.	.75	.75	.75	.75	.75	.75
Barton, Wis.		.50	.75	.75	.75	.75
Boston, Mass.‡	1.60	1.60	2.25	2.00		2.00
Chicago, Ill.	1.20	1.10	1.10			1.00
Columbus, Ohio		.70	.50	.70	.70	
Des Moines, Iowa	.40	.40	1.20	1.50	1.50	1.50
Eau Claire, Wis.	.40	.40	.80	.95		.85
Elgin, Ill.		.20*	.50*	1.50*	1.50*	1.50*
Elkhart Lake, Wis.	.60	.40	.50	.50	.50	.50
Ferrysburg, Mich.		.50@ .80	.60@1.00	.60@1.00		.50@1.25
Ft. Dodge, Iowa	.85	.85	2.05	2.05	2.05	2.05
Ft. Worth, Texas	2.00	2.00	2.00	2.00	2.00	2.00
Grand Haven, Mich.		.40@ .80		.60@1.00		
Grand Rapids, Mich.	.50	.50		.80	.70	.70
Hamilton, Ohio		1.00			1.00	
Hersey, Mich.		.50				.70
Humboldt, Iowa		.85	2.00	2.00	2.00	
Indianapolis, Ind.	.60	.60		.90	.75@1.00	.75@1.00
Mason City, Iowa	.45@ .55	.45@ .55	1.35@1.45	1.45@1.55	1.40@1.50	1.35@1.45
Mankato, Minn.	.50e	.40			1.25	
Mattoon, Ill.	.75	.75	.75	.75	.75	.75
Milwaukee, Wis.		1.01	1.21	1.21	1.21	1.21
Moline, Ill.	.60@ .85	.60@ .85	1.00@1.20	1.00@1.20	1.00@1.20	1.00@1.20
Northern New Jersey	.50	.50	1.25	1.25	1.25	
Oregon City, Ore.		1.25	1.25	1.25	1.25	1.25
Palestine, Ill.	.75	.75	.75	.75	.75	.75
Silverwood, Ind.	.75	.75	.75	.75	.75	.75
St. Louis, Mo.	1.18	1.45	1.65	1.45	1.65	1.45c
Terre Haute, Ind.	.75	.60	.75	.85	.75	.75
Wolcottville, Ind.	.75	.75	.75	.75	.75	.75
Waukesha, Wis.		.45	.60	.60	.65	.65
Winona, Minn.	.40	.40	1.50	1.25	1.10	1.00
Yorkville, Sheridan, Oregon, Moronts, Ill.		.40@ .70	.30@ .50	.50@ .60	.60	.60
Zanesville, Ohio		.60	.50		.80	
SOUTHERN:						
Charleston, W. Va.		All sand, 1.40.		All gravel, 1.50.		
Chattanooga, Tenn.		1.40	1.35	1.20	1.20	1.20
Knoxville, Tenn.	.75@1.00	.75@1.00	1.20	1.20	1.20	1.00
Lindsay, Texas					.55	
Macon, Ga.		.50			.75	
New Martinsville, W. Va.	1.00	.90@1.00		1.30		.80@ .90
Roseland, La.	.50	.50	2.00		1.00	
Smithville, Texas		.90	.90	.90	.90	.75
WESTERN:						
Baldwin Park, Calif.	.20	.20	.40	.50	.50	
Kansas City, Mo.	.80	.70				
Los Angeles, Calif. (d)	.50	.40	.40	.75	.75	.75
Los Angeles district (bunkers)†	1.50	1.40	1.85	1.85	1.85	1.85
Phoenix, Ariz.	1.25*	1.00*	2.50*	2.00*@2.25*	1.75*	1.50*
Pueblo, Colo.	1.10*	.90*		1.60*		1.50*
San Diego, Calif.		.60	1.25	1.20	1.00	1.00
Seattle, Wash. (bunkers)	1.50*	1.50*	1.50*	1.50*	1.50*	1.50*

Bank Run Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
Algonquin and Beloit, Wis.			Dust to 3 in., .40			
Boonville, N. Y.	.60@ .80		.55@ .75			1.00
Chicago, Ill.	.95					
Des Moines, Iowa	.50					
Dudley, Ky. (crushed silica)	1.10	1.10		.90		
East Hartford, Conn.			Sand, .65			
Elkhart Lake, Wis.	.50					
Ferrysburg, Mich.						.65@1.00
Gainesville, Texas		.95				.55
Grand Haven, Mich.						.80@1.00
Grand Rapids, Mich.				.60		
Hamilton, Ohio					.70	
Hersey, Mich.				.50		
Indianapolis, Ind.		Mixed gravel for concrete work, at .65				
Lindsay, Texas						.55
Macon, Ga.		.35				
Mankato, Minn.			Pit run sand, .50			
Moline, Ill. (b)	.60	.60	Concrete gravel, 50% G., 50% S., 1.00			
St. Louis, Mo.			Mine run gravel, 1.55 per ton			
Shining Point, Penn.			Concrete sand, 1.10 ton			
Smithville, Texas	.50	.50	.50	.50	.50	.50
Summit Grove, Ind.	.50	.50	.50	.50	.50	.50
Waukesha, Wis.	.60	.60	.60	.60	.60	.60
Winona, Minn.	.60	.60	.60	.60	.60	.60
York, Penn.	1.10	1.00				

(a) ¾ in. down. (b) River run. (c) 2½ in. and less.
*Cubic yd. †Include freight and bunkerage charges and truck haul. ‡Delivered on job.
(d) Less 10c per ton if paid E.O.M. 10 days. (e) pit run.

Miscellaneous Sands

(Continued from preceding page)

Arenzville, Ill.:	
Core	.75
Molding fine	1.50@ 1.75
Beach City, Ohio:	
Core	1.75
Stone, sawing, coarse	1.75
Molding, fine and coarse, washed	1.75@ 2.25
Traction	1.50@ 2.00
Furnace lining	2.00@ 2.50
Cheshire, Mass.:	
Glass sand, 24 and 40 mesh, bulk	5.00
Columbus, Ohio:	
Core	.20@ 1.50
Traction	.20@ 1.25
Stone sawing	1.50
Brass molding	2.00@ 2.50
Molding fine	1.50@ 2.50
Furnace lining	2.00@ 2.50
Molding coarse	1.50@ 2.00
Sand blast	3.50@ 4.00
Eau Claire, Wis.:	
Sand blast	3.00@ 3.25
Core	1.00
Roofing sand	4.25
Elco, Ill.:	
Ground silica per ton in carloads	18.00@31.00
Elnora, N. Y.:	
Brass molding	1.75
Estill Springs and Sewanee, Tenn.:	
Molding fine and core	1.25
Roofing sand, sand blast, traction	1.35@ 1.50
Franklin, Penn.:	
Core	2.00
Molding, fine and coarse	1.75
Gray Summit and Klondike, Mo.:	
Core, roofing and brass molding	2.00
Molding fine and coarse, traction	1.75
Furnace lining	1.00
Stone sawing	.85@ 1.00
Joliet, Ill.:	
No. 2 molding sand; also loam for luting purposes and open-hearth work	.65@ .85
Kasota, Minn.:	
Stone sawing	1.00
Mapleton Depot, Penn.:	
Glass sand	2.00@ 2.25
Molding fine, coarse and traction	2.00
Massillon, Ohio:	
Core, molding fine and coarse (green), 1.75; dry	2.25
Furnace lining	2.50
Michigan City, Ind.:	
Core and Traction	.15@ .30
Mineral Ridge and Ohlton, Ohio:	
Furnace lining, molding coarse, sand blast, traction (damp)	1.75
Roofing sand (damp)	1.75@ 2.00
Core, molding fine (damp)	2.00
Glass sand (dry)	2.50
Montoursville, Penn.:	
Traction	1.10
Core	1.25@ 1.50
New Lexington, Ohio:	
Molding fine	2.00
Molding coarse	1.50
Oceanside, Calif.:	
Roofing sand	3.50
Ottawa, Ill.:	
Molding coarse (crude silica, not washed or dried)	.75@ 1.00
Red Wing, Minn.:	
Core, furnace lining, stone sawing	1.50
Molding fine and coarse, traction	1.25
Sand blast	3.50
Filter sand	3.75
Ridgeway, Pa.:	
Glass sand	2.15@ 2.50
Molding fine	1.50
Core	1.75
Molding coarse	1.25@ 1.50
Round Top, Md.:	
Core	1.60
Glass sand	2.25
Traction	1.75
Sand blast	2.25
Roofing sand	2.25
St. Louis, Mo.:	
Core	1.00@ 1.75
Furnace lining	1.50
Molding fine	1.50@ 2.50

Miscellaneous Sands

(Continued)

Molding coarse	1.25@ 1.75
Roofing sand	1.75
Sand blast	3.50@ 4.50
Stone sawing	1.25@ 2.25
Traction	1.25
Brass molding	2.00@ 3.00
San Francisco, Calif.:	
(Washed and dried) — Core, sand blast and brass molding	3.50@ 5.00
Furnace lining and roofing sand	3.50@ 4.50
Molding fine and traction	3.50
Molding coarse	4.50
(Direct from pit)—Core and molding fine	2.50@ 4.50
Sewanee, Tenn.:	
Molding fine and coarse, roofing sand, sand blast, stone sawing, traction, brass molding	1.25
Skerkston, Ont.:	
Traction (lake sand)	.65
Tamalco, Ill.:	
Molding coarse	1.25@ 1.50
Tamms, Ill.:	
Ground silica per ton in carloads	20.00@31.00
Thayers, Penn.:	
Core	2.00
Molding fine and coarse	1.25
Traction	2.25
Utica, Ill.:	
Glass sand and brass molding	.75
Molding fine	.60
Core and molding coarse	.55@ 1.25
Furnace lining	.60@ 1.25
Traction	1.00
Roofing and stone sawing	1.00@ 2.50
Sand blast	2.50
Utica, Penn.:	
Core	2.00
Molding fine and coarse	1.75
Warwick, Ohio:	
Core, molding fine and coarse (green)	1.75
Core, molding fine (dry)	2.25
Zanesville, Ohio:	
Molding fine	1.75@ 2.00
Molding coarse	1.50@ 1.75
Brass molding	1.50

Crushed Slag

City or shipping point	Roofing	¼ in. down	½ in. and less	¾ in. and less	1½ in and less	2½ in. and less	3 in. and larger
EASTERN:							
Buffalo, N. Y., Emporium nd Dubois, Pa.	2.25	1.25	1.25	1.25	1.25	1.25	1.25
Eastern Penn. and Northern N. J.	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Reading, Pa.	2.50	1.00		1.25			
Western Penn.	2.50	1.25	1.50	1.25	1.25	1.25	1.25
CENTRAL:							
Ironton, Ohio	2.05	1.35	1.65	1.45	1.35	1.45	1.45
Jackson, Ohio		1.05		1.30	1.05	1.30	1.30
Toledo, Ohio	1.50	1.25	1.25	1.25	1.25	1.25	1.25
Youngst'n, O., dist.	2.00	1.25	1.35	1.35	1.25	1.25	1.25
SOUTHERN:							
Ashland, Ky.		1.45		1.55	1.45	1.55	1.55
Ensley and Alabama City, Ala.	2.05	.80	1.35	1.25	.90	.90	.80
Longdale, Roanoke, Ruessens, Va.	2.50	1.00	1.25	1.25	1.25	1.15	1.15

Lime Products (Carload Prices Per Ton F.O.B. Shipping Point)

	Finishing hydrate	Masons' hydrate	Agricultural hydrate	Chemical hydrate	Ground burnt lime, Blk.	Ground burnt lime, Bags	Lump lime, Blk.	Lump lime, Bbl.
EASTERN:								
Berkeley, R. I.			12.00					2.20
Buffalo, N. Y.		10.00		12.00				
Lime Bridge, Penn.							5.00a	
West Stockbridge, Mass. (f)	13.00	10@11.00	5.00					2.25t
Williamsport, Penn.			10.00				6.00	
York, Penn.		10.50	10.50	11.50	9.00	10.50	8.50	1.65i
CENTRAL:								
Cold Springs, Ohio (f)	12.50	10.00	9.00		9.00	11.00	9.00	
Delaware, Ohio	12.50	10.00	9.00	10.00			9.00	1.50
Gibsonburg, Ohio (f)	12.50	10.00	9.00		9.00	11.00	9.00	
Huntington, Ind.	12.50	10.00	9.00					
Luckey, Ohio (f)	12.50							
Marblehead, Ohio		10.00	9.00				9.00	1.50c
Marion, Ohio		10.00	9.00				9.00	1.50c
Sheboygan, Wis.							9.50	
Tiffin, Ohio					9.00			
White Rock, Ohio	12.50				9.00	11.00		
Woodville, Ohio	12.50	8.00	9.00		9.00	10.00	9.00	1.50
SOUTHERN:								
Allgood and Saginaw, Ala.	12.50	10.00		10.00		1.35u	8.50	1.50
El Paso, Texas							10.00	1.75
Graystone, Landmark and Wilmay, Ala.	12.50	10.00		850.@10.00		1.35u	8.50	1.50
Karo, Va.		10.00	9.00				7.00g	1.65h
Knoxville, Tenn.	20.50	11.00				1.35	8.00	1.50
Ocala and Zubz, Fla.	12.50	12.00	10.00				12.00	1.70
Varnons, Ala. (f)		10.00p	10.00p				8.00q	1.40r
WESTERN:								
Kirtland, N. M.							15.00	
San Francisco, Calif.	21.00	21.00	15.00	21.00			14.50	1.90v
Tehachapi, Calif.			8.00				13.00z	2.20x

†50-lb. paper bags; (a) run of kilns; (c) wooden, steel 1.70; (d) wood; (e) per 180-lb. barrel; (f) dealers' prices; (g) to 9.50; (h) to 1.75; (i) 180-lb. net barrel 1.65; 280-lb. net barrel, 2.65 (m) finishing lime, 3.00 common; (n) common lime; (o) high calcium; (p) to 11.00; (q) to 8.50; (r) to 1.50; (s) in 80-lb. burlap sacks; (t) common, 2.50 plastering; 3.00 finishing; (u) two 90-lb. bags; (v) wood burnt; (x) wood, steel $2.30; (z) to $15.00.

*Quoted f.o.b. New York.

Talc

Prices given are per ton f.o.b. (in carload lots only), producing plant, or nearest shipping point.

Baltimore, Md.:	
Crude talc (mine run)	3.00@ 4.00
Ground talc (20-50 mesh), bags	10.00
Cubes	55.00
Blanks (per lb.)	.08
Pencils and steel worker's crayons per gross	.08 1.25
Chatsworth, Ga.:	
Crude talc	4.00
Ground (20-50 mesh), bags extra	7.00
Ground (150-200 mesh), bags extra	8.00
Chester, Vt.:	
Ground (150-200 mesh), bulk	8.00@ 9.00
Including bags	10.00@11.00
Chicago and Joliet, Ill.:	
Ground (150-200 mesh), bags	30.00
Dalton, Ga.:	
Crude talc	5.00
Ground talc (150-200) bags	10.00
Pencils and steel workers' crayons, per gross	1.00@ 2.50
Emeryville, N. Y.:	
(Double air floated) including bags; 325 mesh	14.75
200 mesh	13.75
Hailesboro, N. Y.:	
Ground white talc (double and triple air floated) including bags, 350 mesh	15.50@20.00
Henry, Va.:	
Crude (mine run)	3.50@ 4.00
Ground talc (150-200 mesh), bags	9.75@15.00
Joliet, Ill.:	
Ground talc (150-200) bags	30.00
Keeler, Calif.:	
Ground (200-300 mesh), bags	20.00@30.00
Natural Bridge, N. Y.:	
Ground talc (300-325 mesh), bags	13.00

Rock Phosphate

Prices given are per ton (2240-lb.) f.o.b. producing plant or nearest shipping point.

Lump Rock

Gordonsburg, Tenn.—B.P.L. 68-72%	4.50@ 5.00
Tennessee—F. O. B. mines, gross ton, unground Tenn. brown rock, 72% min. B.P.L.	5.50
Twomey, Tenn.—B.P.L. 65%, 2000 lb.	7.00@ 8.00

Ground Rock

(2000 lbs.)

Centerville, Tenn.—B.P.L. 65%	7.00
Gordonsburg, Tenn.—B.P.L. 68-72%	4.00@ 5.00
Mt. Pleasant, Tenn.—B.P.L. 65%; bulk, 7.00; bags	9.00
Twomey, Tenn.—B.P.L. 65%	7.00@ 8.00

(Continued on next page)

Cement Tile (Other Cement Products Prices on Page 82)

Prices are net per sq. in carload lots, f.o.b. nearest shipping point unless otherwise stated.

Cicero, Ill.	Hawthorne tile, per sq.
Red Spanish	10.00
Green Spanish	12.00
Red French	9.50
Green French	11.50

	—Cicero— Red	Green
Ridges	.25	.35
Hips	.20	.30
Ridge closers	.05	.06
Hip terminals, 3 way	1.25	1.50
Hip starters	.50	.60
Gable finials	1.25	1.50
Gable starters	.20	.30
End bands	.20	.30
Eave closers	.06	.08

Camden and Trenton, N. J.—8x12, per sq.	
Red	15.00
Green	18.00
Cement City, Mich. — 5"x8"x12", per M	55.00
Detroit, Mich.—5x8x12, per C	8.00
Grand Rapids, Mich.:	Per 1000
5x4x12	45.00
5x8x12	70.00
5x8x 6	35.00
Houston, Texas.—Roofing Tile, per sq.	
Red	17.00
Green	19.50
	Per 1000
5x4x12 (Lightweight)	45.00
5x8x12 (Lightweight)	80.00
Indianapolis, Ind.—9"x15"	
Gray	10.00
Red	11.00
Green	13.00
Longview, Wash.—(Stone Tile)	Per 1000
4x6x12	60.00
4x8x12	65.00
Mt. Pleasant, N. Y.:	Per 1000
5x8x12	78.00
Pasadena, Calif.:	Per 1000
4x4x12	$30.00
4x6x12	50.00
4x8x12	60.00
Waco, Texas:	Per sq.
4x4	.60
Wildasin Spur, Los Angeles, Calif:	
4x3½x12	.03½
6x3½12	.04½
8x3½x12	.05½
Yakima, Wash.:	
5x8x12	.10

Milwaukee, Wis.	*13.00
New Brighton, Minn.	10.00
Pontiac, Mich.	13.77
Portage, Wis.	15.00
Rochester, N. Y. (del. on job)	19.75
Saginaw, Mich.	13.00
San Antonio, Texas	13.00@13.50
Sebewaing, Mich.	11.00
Syracuse, N. Y.	18.00
Terra Cotta, D. C.	13.50
Toronto, Canada	*15.60
Wilkinson, Fla.-White	12.00
Buff	16.00

*Delivered on job. †Delivered in city limits.

Portland Cement

Prices per bag and per bbl, without bags net in carload lots.

	Per Bag	Per Bbl.
Albuquerque, N. M.	....	3.47
Atlanta, Ga.	....	2.75*
Baltimore, Md.	....	2.35
Birmingham, Ala.	....	2.50*
Boston, Mass.	....	2.63
Buffalo, N. Y.	....	2.38
Butte, Mont.	.90¼	3.61
Cedar Rapids, Iowa	....	2.34
Charleston, S. C.	....	2.85
Cheyenne, Wyo.	.86½	3.46
Cincinnati, Ohio	....	2.37
Cleveland, Ohio	....	2.29
Chicago, Ill.	....	2.10
Columbus, Ohio	....	2.34
Dallas, Texas	.48¾	2.15
Davenport, Iowa	....	2.29
Dayton, Ohio	....	2.38
Denver, Colo.	.66¼	2.65
Detroit, Mich.	....	2.15
Duluth, Minn.	....	2.09
Houston, Texas	....	2.60
Indianapolis, Ind.	....	2.29
Jackson, Miss.	....	3.00*
Jacksonville, Fla.	....	2.85
Jersey City, N. J.	....	2.33
Kansas City, Mo.	....	2.33
Los Angeles, Calif.	.63	2.52
Louisville, Ky.	....	2.27
Memphis, Tenn.	.65	2.60
Milwaukee, Wis.	....	2.25
Minneapolis, Minn.	....	2.32
Montreal, Que.	....	1.90
New Orleans, La.	....	2.80*
New York, N. Y.	....	2.25
Norfolk, Va.	....	2.35
Oklahoma City, Okla.	....	2.56
Omaha, Neb.	....	2.51
Peoria, Ill.	....	2.27
Philadelphia, Penn.	....	2.41
Phoenix, Ariz.	....	3.70
Pittsburgh, Penn.	....	2.09
Portland, Ore.	....	2.60
Reno, Nevada	.75¼	3.01
Richmond, Va.	....	2.47
Salt Lake City, Utah	.70¼	2.81
San Francisco, Calif.	....	2.31
Savannah, Ga.	....	2.85
St. Louis, Mo.	.57½	2.20
St. Paul, Minn.	....	2.32
Seattle, Wash. (10c discount)	....	2.65
Tampa, Fla.	....	3.05
Toledo, Ohio	....	2.20
Topeka, Kans.	....	2.40
Tulsa, Okla.	....	2.43
Wheeling, W. Va.	....	2.17
Winston-Salem, N. C.	....	3.19*

NOTE—Add 40c per bbl. for bags.

Mill prices f.o.b. in carload lots, without bags, to contractors.

	Per Bag	Per Bbl.
Buffington, Ind.	....	1.95
Chattanooga, Tenn.	....	2.45*
Concrete, Wash.	....	2.35
Davenport, Calif.	....	2.05
Detroit, Mich.	....	2.15
Hannibal, Mo.	....	2.05
Hudson, N. Y.	....	2.05
Leeds, Ala.	....	1.95
Mildred, Kans.	....	2.35
Nazareth, Penn.	....	1.95
Northampton, Penn.	....	1.95
Steelton, Minn.	....	2.00
Toledo, Ohio	....	2.20
Universal, Penn.	....	1.95

*Including sacks at 10c each.

(Continued from preceding page)

Florida Phosphate

(Raw Land Pebble)

(Per Ton.)

Florida—F. O. B. mines, gross ton, 68/66% B.P.L., Basis 68%	2.50
70% min, B.P.L., Basis 70%	2.75
72% min. B.P.L., Basis 72%	3.00
75/74% B.P.L., Basis 75%	4.00

Fluorspar

Fluorspar, 85% and over calcium fluoride, not over 5% silica, per net ton, f.o.b. Illinois and Kentucky mines	16.00
No. 2 lump, per net ton	19.00
Fluorspar, foreign, 85% calcium fluoride, not over 5% silica, c.i.f. Philadelphia, duty paid, per net ton	16.00
Fluorspar, No. 1 ground bulk, 95 to 98% calcium fluoride, not over 2½% silica, per net ton, f.o.b. Illinois and Kentucky mines	32.50

Special Aggregates

Prices are per ton f.o.b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco-chips
Barton, Wis., f.o.b. cars	....	10.50
Brandon, Vt.—English pink and English cream	*11.00	*11.00
Chicago, Ill. — Stucco chips, in sacks f.o.b. quarries	....	17.50
Crown Point, N. Y.—Mica Spar		8.00@10.00
Easton, Pa., and Phillipsburg, N. J.—Green grits or facings		1.50@ 3.00
Haddam, Conn. — Felstone buff	15.00	15.00
Harrisonburg, Va.—Blk marble (crushed, in bags)	†12.50	†12.50
Ingomar, Ohio		6.00@18.00
Middlebrook, Mo.—Red		20.00@25.00
Middlebury, Vt.—Middlebury white	‡9.00	‡9.00
Milwaukee, Wis.		14.00@34.00
Newark, N. J.—Roofing granules		7.50
New York, N. Y.—Red and yellow Verona	....	32.00
Red Granite, Wis.	....	7.50
Sioux Falls, S. D.	7.50	7.50
Stockton, Calif. — "Natrock" roofing grits		14.00
Tuckahoe, N. Y.	....	12.00

Villa Grove, Colo	13.00
Wauwatosa, Wis.	16.00@45.00
Wellsville, Colo.—Colorado Travertine Stone 15.00	15.00

†C.L. Less than C.L., 15.50.
*C.L. including bags; L.C.L. 14.50.
‡C.L. including bags; L.C.L. 10.00.

Potash Feldspar

(Pulverized)

Auburn and Brunswick, Me.—Color, white; 98% thru 140 mesh bulk	19.00
Bath, Me.—Color, white; analysis, potash, 12%; 100% thru 180 mesh, bags, 21.00; bulk	18.00
Erwin, Tenn.—Color, white; analysis, 12.07% K_2O, 19.34% Al_2O_3; Na_2O, 2.92%; SiO_2, 64.76%; Fe_2O_3, .36%; 98.50% thru 200 mesh, bags, 16.90; bulk	15.50
Los Angeles, Calif.—Color, white; analysis, K_2O, 10.35%; Na_2O, 3.62%; Al_2O_3, 18.71%; SiO_2, 65.48%; Fe_2O_3, .17%; 100% thru 150 mesh, bags, 24.00; bulk	22.00
Trenton, N. J.—Crude, bulk (Bags 11 cents each, non-returnable)	12.00@27.00
Wheeling, W. Va.—Color, white; analysis., K_2O, 9.50%; Al_2O_3, 16.70%; Na_2O, 3.50%; SiO_2, 69.50%; 99% thru 140 mesh, bulk	19.00
Glen Tay, Ontario, Can.—Color, flesh red to pink; analysis, K_2O, 12.81%; Fe_2O_3, .11%, etc., crude, bulk	7.00@ 7.50

Blended Feldspar

(Pulverized)

Tenn. Mills—Bulk	16.00@20.00
Toughkenamon, Pa.—Color, white to light cream; 98% thru 125-150 mesh, bags, 12.00@13.00; bulk	10.00

Chicken Grits

Toughkenamon, Pa.—(Feldspar) 100-lb. bags, 1.00; bulk, per ton	10.00

Sand-Lime Brick

Prices given per 1000 brick f.o.b. plant or nearest shipping point, unless otherwise noted.

Barton, Wis.	10.50
Boston, Mass	14.50
Brighton, N. Y.	*19.75
Dayton, Ohio	12.50@13.50
Detroit, Mich.	*17.50
Farmington, Conn.	14.00
Flint, Mich.	16.00@19.00
Grand Rapids, Mich	12.00
Hartford, Conn.	14.00
Jackson, Mich.	13.00
Lancaster, N. Y.	13.00
Madison, Wis.	†13.00
Michigan City, Ind.	12.00

Gypsum Products—CARLOAD PRICES PER TON AND PER M SQUARE FEET, F. O. B. MILL

	Crushed Rock	Ground Gypsum	Agricultural Gypsum	Stucco Calcined Gypsum	Cement and Gauging Plaster	Wood Fiber	White Gauging	Sanded Plaster	Keene's Cement	Trowel Finish	—Plaster Board— ¼x32x 36". Wt. 1500 lb. Per M Sq. Ft.	⅜x32x 36". Wt. 1850 lb. Per M Sq. Ft.	Wallboard, ⅜x32 or 48". Lgths. 6'-10', 1850 lb. Per M Sq. Ft.
Centerville, Iowa	3.00	3.50	15.00	8.00	9.00	9.50	9.50	....	25.80	10.00	....	....	....
Douglas, Ariz.	....	....	7.00	....	....	15.50d	18.50	....	30.00	15.50	....	....	....
Grand Rapids, Mich.	1.50@1.75	....	6.00	9.00@11.00	8.00@10.00	8.00@10.00	....	....	30.00	....	....	....	30.00
Gypsum, Ohio‡	3.00	4.00	6.00	8.00	9.00	9.00	18.00	7.00	27.00	18.00	....	20.00	30.00
Hanover, Mont.	....	....	....	11.80	....	....	....	....	....	....	....	....	....
Los Angeles, Calif.	....	....	....	10.30k	....	....	....	....	....	....	....	....	....
Port Clinton, Ohio	3.00	4.00	6.00	10.00	9.00	9.00	21.00	7.00	30.15	20.00	....	20.00	30.00
Portland, Colo.	....	....	....	10.00	....	....	....	....	....	....	....	....	....
San Francisco, Calif.	....	....	....	....	16.40	....	17.40	....	....	....	....	....	....
Sigurd, Utah	....	....	....	....	....	....	....	....	18.00a	....	....	....	....
Winnipeg, Man.	5.00	5.00	7.00	13.00	14.00	14.00	....	....	....	....	20.00	25.00	33.00

NOTE—Returnable bags, 10c each; paper bags, 1.00 per ton extra (not returnable).
***To 3.00; †to 11.00; ‖to 12.00; ‡prices per net ton, sacks extra; (a) to 21.00; (b) net; (c) gross.**
(d) hair fibre; (f) delivered; (h) delivered in 6 states; (i) delivered on job; (k) sacks 12c extra, rebated.

New Machinery and Equipment

New Type of Recording

A NEW recording pyrometer which is said to combine with high accuracy and unusually desirable features, has been developed during the past five years by the research department of the Brown Instrument Co., Philadelphia, Penn.

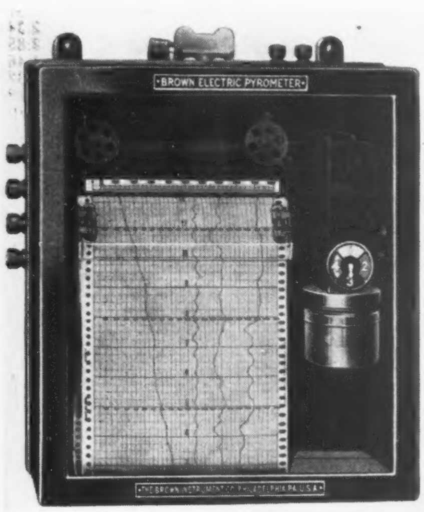


Fig. 1. Although the new recording pyrometer uses a 7-in. chart, the space required is small

This company has been making pyrometers for 65 years, and its history shows continuous development and improvement of scientific instruments.

Many features in the recording pyrometer just developed are radically new and patents have been applied for covering these improvements, some of which are listed below.

The new Brown recorder has a die cast black enameled aluminum case. The dimensions are 15 in. high, 14 in. wide and 9 in. deep, requiring a minimum amount of wall space considering the unusually wide 7-in. chart.

The instrument is built to make a single record, a duplex record with two records side by side, or in multiple form produces as many as 12 records on one chart.

It operates on the frictionless principle in which a pointer swings freely and at intervals of every 30 seconds is depressed on a carbon or inked ribbon producing a mark on the chart. These marks are so close together as to form a continuous line. The marking ribbon and chart last two months before renewal is required and no inking is necessary.

The marking ribbon is above the paper so that the mark is produced on the front side of the paper where it shows clearly. The marking ribbon in the single and duplex recorder after each mark on the chart is moved back disclosing the last impression so that the record is clearly visible immediately after it is produced. (Fig. 2.)

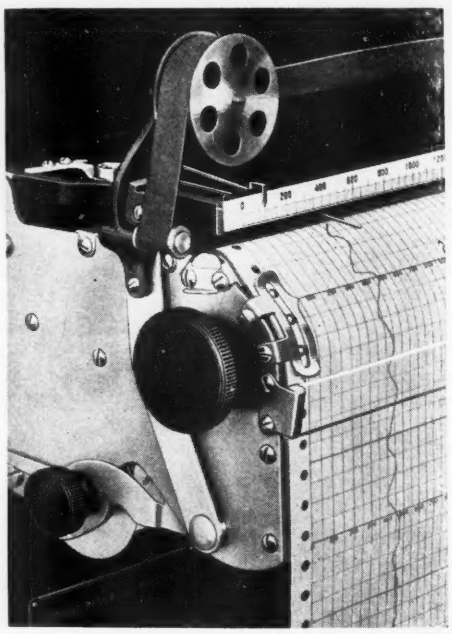


Fig. 2. The marking ribbon is moved back after each mark, disclosing the mark as soon as it is made

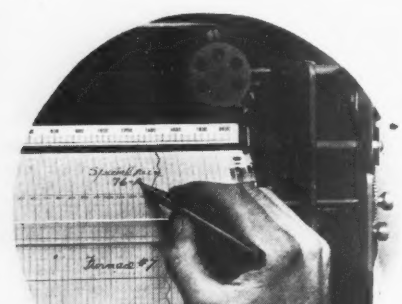


Fig. 3. A platen is supplied so that notes may be made in pen or pencil

A platen is supplied on which notes can be recorded on the chart with pen or pencil. (Fig. 3.)

A glass knife edge is furnished for tearing off the paper and is located directly below the driving roll. The paper can be torn off two hours after the last impression is made. For example, a complete record for the previous 24 hours and ending at 6:00 a.m. can be torn off about 8:00 a.m. (Fig. 4.)

The galvanometer and the recording chart mechanism is carried on a hinged frame. When swung aside, the galvanometer is instantly accessible, and when closed a housing protects the galvanometer. (Fig. 5.)

In addition to recording the temperature on the chart, an indicating scale is provided with large figures legible at a considerable distance. The chart has rectangular coordinates. The time lines are straight across the chart and not curved as in other instruments.

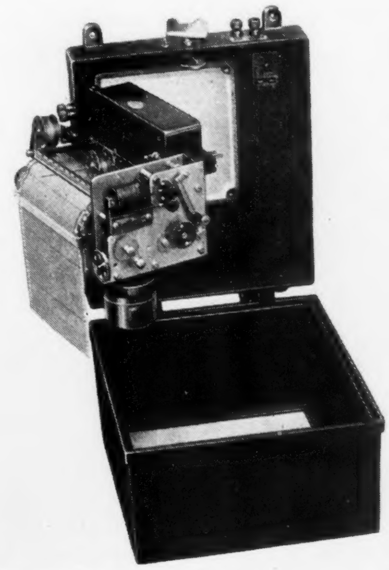


Fig. 5. Galvanometer and recorder are on a hinged frame and are easily accessible

The recorder is driven by an electric clock if alternating current is available. The current consumed by this clock is only 4 watts. Six recorders are said to consume the current required by the common 25-watt incandescent lamp. The electric clock elimi-

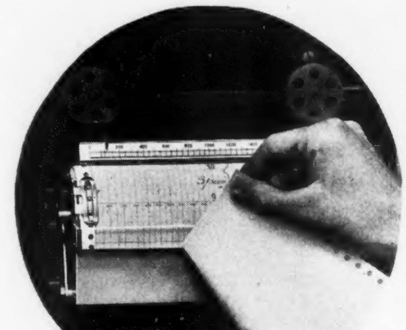


Fig. 4. The record may be torn off on a glass knife edge

nates hand winding and no governor or other means is needed to secure accurate timing. Where alternating current is not available, a hand wound clock can be supplied.

The chart speed can readily be changed and is supplied for a number of combinations. The standard chart speed is 1 in. per hour but by reversing two gears a speed of

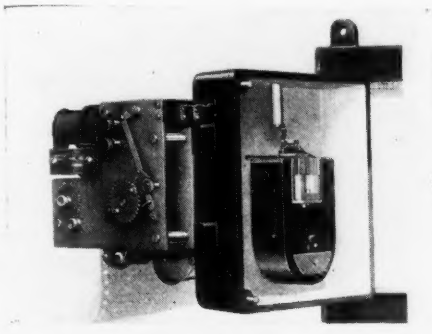


Fig. 6. Enclosed galvanometer and speed change gears

4 in. per hour is obtainable. Speed combinations are available from ¼-in. per hour to 6 in. per hour.

With a standard chart speed of 1 in. per hour, about 12 hours of chart is visible through the front of the case.

The instrument as a pyrometer incorporates automatic cold junction compensation including the Brown patented index for adjusting a compensated pyrometer to the correct initial starting point on open circuit.

A re-roll attachment is furnished where desired to roll up the chart automatically over a long period of time.

As a multiple recorder, this instrument incorporates an automatic switch with gold contacts mounted on bakelite and immersed in oil, which presents any possibility of tarnishing of the contacts from corrosive gases in the atmosphere.

The multiple recorder switch includes a dial with index for indicating the number of the thermocouple or furnace which is being recorded at the time. The record lines are made in different color combinations on the chart and the switch dial is numbered and colored to correspond.

The simplicity of this instrument constitutes the most marked advantages for it has no solenoids, no motors requiring governors for speed control, no hand winding where the electric clock is used, no inking of pen and no frequent renewal of the chart which lasts two months.

The "Texrope" Drive

AN IMPORTANT development in the field of power transmission machinery has just been announced by the Allis-Chalmers Manufacturing Co., who have recently perfected an entirely new type of short center, flexible drive, known as the "Texrope" drive.

The Texrope drive consists of two grooved sheaves and a number of specially constructed endless "V" belts. The sheaves are set just far enough apart so that the belts fit the grooves without tension or slack.

Since the Texrope belts just fit the sheaves, it is claimed, there is no slack or lost motion in the drive, because of the "V" construction, they cannot slip, as the harder the pull the more firmly the belts grip the grooves; being elastic and stretchable, they cannot jerk, either in starting, acceleration or running, nor can they transmit vibrations, but act as cushions between the driving and driven machines. Therefore smoothness of transmission is delivered by the Texrope drive, as opposed to the series of linear pulsations delivered by the ordinary short center drive.

The following claims are made for the new drive:

"Bearing pressures are low, since no belt tension is employed. The drive occupies very little space. It is silent, perfectly clean, unaffected by moisture or dirt, and is safe, simple and trouble proof. Since there is no slip, the speed ratios are fixed and exact. It is durable, and each belt carries its proportional share of the load.

"Texrope drives from ½ to 250-h.p., with ratios up to 7 to 1 and belt speeds from 800-6000 ft. have already been placed in service. They have been applied to nearly every industry."

High Temperature Insulation*

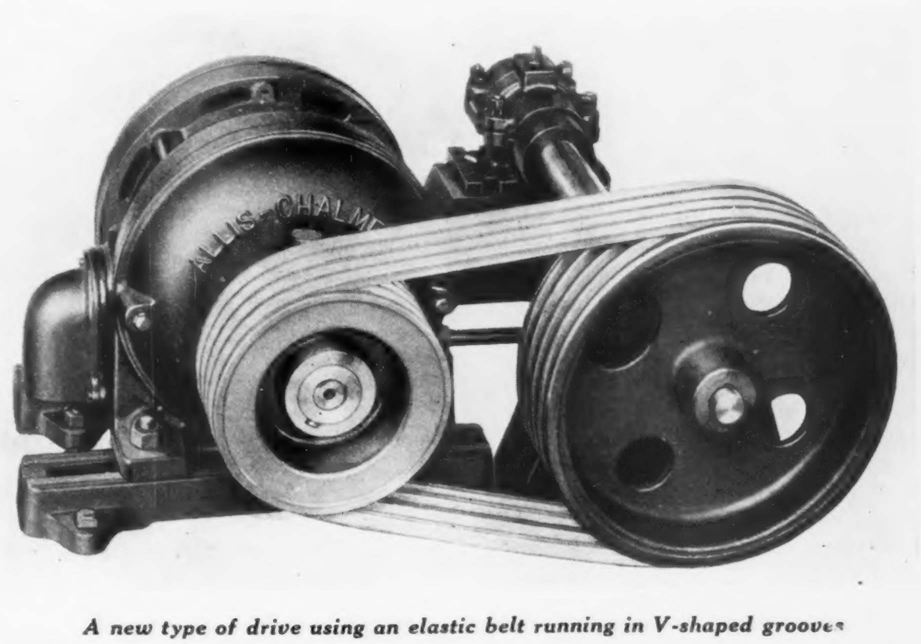
RADIATION losses are matters of great concern to all manufacturers who operate kilns or burners that require high temperatures. So great is this loss that data compiled from authorities shows it to be about $1,000,000,000 per year and that it comprises over 25% of the total available heat in the fuel.

Recent tests carried out in the Bureau of Mines disproved the common belief that air spaces were good insulators at high temperatures. The reason being the increased activities of the air at high temperature and the consequent rapid connection. The best way to overcome this was by proper insulation of solid material. Either the walls must be of great thickness (in which case a large amount of heat not used in productive work is used up) or of some material of lower thermal conductivity, correctly called an insulator. The rate of heat flow through a wall is dependent on the resistance of the component materials to the heat waves. Generally speaking, a material of low apparent density and which contains a number of small "voids" or cells containing air is considered a good insulator.

The relative thermal capacities of representative refractory material have been tested and the results are in favor of a material which is practically pure silica of high melting point. This material has a low conductivity due to the fact that 85% of its volume consists of minute air cells. When used in brick form it should be laid with a mortar made of the same material in order to secure well insulated joints. In powder form it can be placed between the inner fire brick lining and the outer steel shell. Likewise the bricks should be placed between the inner refractory and the outer steel jacket.

The thickness of the insulator should be determined by taking reckoning of all the losses by radiation which occur in the use of ordinary materials and the temperatures used in the kiln, furnace, boiler, etc. The advantages of proper insulation are not only in the saving of fuel, but also in the uniform temperatures maintained, easier and more accurate control, and uniform distribution of heat. It also increases the capacity of the equipment, protects the brick work from rapid temperature changes, thus reducing strains and cracking and makes a general improvement in working conditions about the equipment. Insulation may be employed without danger to refractories in any equipment operating at temperatures up to 2600 deg. F. Beyond that, special care must be made in the choice of the material.

*Abstract from "High Temperature Insulation," compiled by the Celite Products Co., Los Angeles, Calif.



A new type of drive using an elastic belt running in V-shaped grooves

The Rock Products Industry in California

(Extract from an article by D. C. Newmarch, Industrial Engineer, Chamber of Commerce, in the Los Angeles, Calif., *Times.*)

WITH ever-increasing demand for the nonmetallic minerals it behooves us to take stock of what we are doing to keep up with the demand and to increase the demand for local products not only here but all over the United States. With an area which is unequaled anywhere in the world for diversity and quality of nonmetallics the increase in value of production of 1923 over 1922 is not so great as it should be, more especially in view of the enormous building program of the United States into which so many of the nonmetallics enter in the shape of cement, gypsum and magnesite.

The importance of the nonmetallics in the building business is evidenced by the fact that the building materials men are now sending out parties of graduate mineralogists to prospect for minerals which have heretofore been passed over by the old type of prospector. I have in mind one firm of building material supplies which not only sends out such parties, but takes advantage of the airplane for preliminary work, and I may say that they have recently been able to acquire a remarkably fine gypsum deposit.

Inaccessibility to railroads and high freight charges have operated against the California minerals, allowing the foreigner to come in and sell us stuff that is in very many cases not so good as that we have lying practically at our doorstep. This has been particularly true of silica, which has been heretofore brought in in large quantities from Belgium. Cement also has been dumped here from Germany and Belgium.

I have endeavored to show in the following lines some data on cement, gypsum, magnesite and lime.

After petroleum, cement is produced to a greater extent than any other nonmetallic; the production for the last five years being 1919, 4,645,289 bbl.; 1920, 6,709,160 bbl.; 1921, 7,404,221 bbl.; 1922, 8,962,135 bbl.; and 1923, 10,825,405 bbl., of a total value of $84,150,314.

In point of production California is only exceeded by Pennsylvania but its per capita consumption is more than twice that of the balance of the United States. Taking into consideration the amount of building being done in California this is not to be wondered at. There are eleven plants making cement in the state, three in San Bernardino county and one each in Contra Costa, Kern, Riverside, San Benito, Santa Cruz, Solano, Merced and San Mateo counties.

The close proximity of crude oil and natural gas supplies creates very favorable manufacturing conditions in California for the cement industry. California being the only state using oil and natural gas entirely.

With an increase in building operations in 1923 of 35% over 1922, and with an enormous program in view for the future, there is a good opportunity for other plants, and I do not understand the slowness of local and eastern financiers to realize this fact. The road and highway development now taking place in California, which has really only just started, will necessitate the use of thousands upon thousands of barrels of cement, and in this connection it may be well to mention that it is high time we stopped the indiscriminating dumping of foreign cements into California. I had experience in foreign cements 30 years ago, when the foreign manufacturers were turning out real first-class cement. Now, however, judging from a series of tests made by the city of Los Angeles, their product has not only fallen off in quality very much, making it in every way inferior to the local product, but there seems to be great carelessness in bagging, as the weights vary so much per bag that it requires great care to keep the batches uniform.

The fact that there is no plant making mason's, natural or puzzolan cements in California is worthy of note and will, no doubt, be acted upon by some one with a vision of the present and future needs of California in this respect. The per-capita consumption of cement for the United States is approximately one and one-quarter barrels per year, whereas the average for California is approximately two and one-quarter barrels, based on the United States portland cement survey of 1923.

Gypsum appears to me to be one of the nonmetallics that will bear much more searching for and much greater development, being used in so many industries and in very large quantities. There are deposits of gypsum in Imperial, Kern, Riverside and Santa Bernardino counties. At present there is one operator in each of the above-named counties. In 1922 these operators supplied the market with 47,048 tons of gypsum. In addition to this the United States Gypsum Co. brought in, during 1922, 100,000 tons from Nephi, Utah, and Arden, Nev., of which 65,000 tons were brought in for Los Angeles consumption. In 1923 the California operators had increased their output to 86,410 tons, nearly twice the amount of the previous year. The majority of the gypsum mined is used in plaster board and hard wall plasters, cement (as a retarder), and plaster of paris. Gypsum is coming into prominence in the form of tile for partitions, stair walls and elevator shafts.

Limestone occurs in no less than fifteen counties of California, including San Bernardino, Contra Costa, Kern, Napa, Riverside, Santa Cruz, Solano, El Dorado, Inyo, Tuolumne, Santa Clara, Shasta, Siskiyou, Tulare and Imperial, yet the majority of the lime used in California comes from Nevada. In this instance the high cost of freight is largely responsible. Sugar refiners around the San Francisco Bay use very large quantities of limestone, which must be around 95% pure to be of value for this purpose. Other industries using large amounts are glass making and foundries. For building purposes the limestone is largely used in the make-up of putty, kalsomine, paint filler, and for terazzo. Production of limestone for 1923 in California was 143,266 tons, an increase over 1922 of practically 60,000 tons.

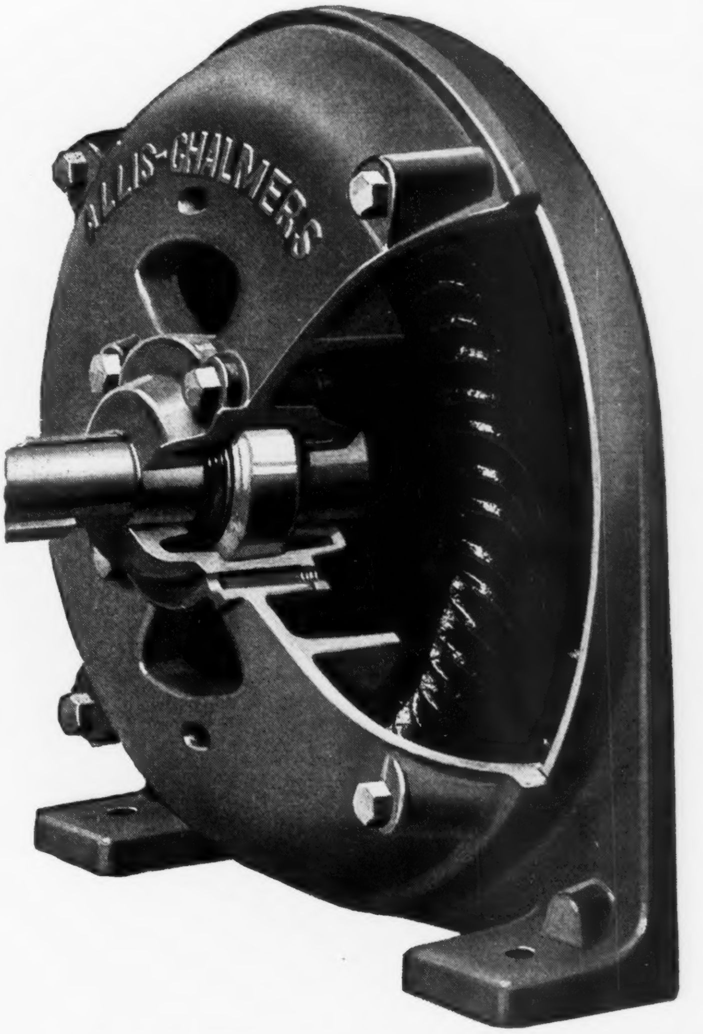
Lime as distinguished from limestone is reported on a production basis from Kern, San Bernardino, Santa Cruz, Shasta, Siskiyou and Tuolumne counties; these counties produced during 1923 70,894 tons, practically all of this being used in building operations.

During the last twelve months a large deposit of shell lime has been discovered in Los Angeles county in the neighborhood of Saugus. California is, however, at present very dependent on Nevada for lime, which is brought in from Sloan and Nephi in both raw and hydrated forms. The production of lime in California during 1923 was 13,000 tons over that of 1922, so that in course of time this dependence on Nevada and other outside points may be overcome, 1923 was, in fact, the banner year for lime production, being the highest on record.

Railway Ballast

LET us now consider briefly the item of ballast. While I can appreciate that in most organizations the roadmaster has nothing to do with providing funds necessary for additions and betterments, and in many cases ballasting involves additions and betterments expenditures, on the other hand the roadmaster is depended upon largely to recommend the ballast, to find a satisfactory material and to apply it properly. It is impossible to maintain a standard main track most economically in most sections of our country and make it serviceable for the traffic requirements, without the use of ballast. Ballast improves the riding qualities, preserves rail and ties, and reduces the cost of labor. In my opinion it would be a great error of omission if roadmasters did not fully appreciate their responsibility in calling to the attention of their superiors those items which will bring about economies in track maintenance, and the item of ballast is one of them. Let us think more of ways and means to reduce the $2,200,000 daily expense on American railroads in the maintenance of way and structures.—C. E. Johnston, vice-president and general manager, Kansas City Southern Railway, in an address before the Roadmasters' Association, Kansas City, Mo.

Now in Every Type —Allis-Chalmers Excellence



Thousands of electric motor users have been accustomed to Allis-Chalmers motors exclusively, for all purposes. Confidence in Allis-Chalmers rests upon a long series of impressive developments in motor design. Now comes the latest addition to the Allis-Chalmers line —an induction motor equipped with Timken Tapered Roller Bearings.

Into Allis-Chalmers motors have been incorporated the typical advantages of tapered roller bearings, so completely endorsed in dozens of other exacting applications. Friction at a minimum, lubrication at rare intervals, permanent alignment, protection from thrust and shock — these coveted betterments are now obtainable in Allis-Chalmers induction motors.

Add such well known Allis-Chalmers refinements as electric steel frames, distortionless cores, silver-brazed rotor bars and uniform cooling. The result is a motor that expresses highest development in electric motor design.

Lower cost of operation, negligible upkeep, and security against interrupted service are the logical outcome of latest Allis-Chalmers advancements. A request will bring complete information on Allis-Chalmers roller bearing motors, or on any type of Allis-Chalmers motor.

ALLIS-CHALMERS MFG. CO.
Milwaukee

District Sales Offices in all Principal Cities

ALLIS-CHALMERS MOTORS

News of All the Industry

Incorporations

Helderberg Cement Co., Howes Cave, N. Y., dissolved.

Limoges, Fils and Co., Montreal, Canada, to manufacture lime, have been registered.

Kenosha Sand and Gravel Co., Kenosha, Wis., $100,000. J. J. and K. M. McClory, W. H. Melbusch.

General Materials Co., Wilmington, Del., $500,-000. To mine rock, sand, etc. (Corp. Trust of America.)

Madison Sand and Gravel Corp., Hamilton, N. Y., 750 to 1500 common, no par and 750 shares $100 par.

Rollin Sand and Building Block Co., Minneapolis, Minn., $50,000, by H. G. Rollin, 3532 40th Ave., S., and others.

Wilson Cement Brick Co., $40,000, Toronto, Canada. Have established a cement brick plant on Eglington Ave., Toronto.

Granite Homes Co., Columbia, S. C., $10,000. Burnie Pride and G. I. Rentz of 1015 Queen St., will develop stone quarry.

Mangold Sand Co., Zanesville, Ohio, $25,000. H. A. Mangold, E. R. Meyer, T. O. and E. Crossan and T. O. Toller.

Monolithic Concrete Construction Co., 808 E. Fayette St., Baltimore, Md. E. Harry Frost, Douglas H. Rose and others.

I. R. C. Sand and Gravel Co., Ironton, Ohio, $50,000. J. L. Wilson, G. C. and L. Harden, W. Prindle and J. L. Wilson, Jr.

Blue Diamond Mortar Co., Baltimore, Md., Peter E. Tome, president. Will erect $50,000 plant at 25th street and Taylor avenue.

American Rock Co., Portland, Ore., has been formed by John Gallagher and R. E. Kramer. The company will erect and operate a sand and gravel plant.

Rye Chester Concrete Block and Sand Co., Rye, N. Y., $30,000. M. B. Weir, A. W. McKay and C. H. Fuchs. (Attys., Peck & Schmidt, Port Chester, N. Y.)

Lo Forti Brick Co., Hialeah, Fla., $300,000. Twain Michelsen and Joseph Lo Forti. Will establish plant to manufacture concrete brick, daily output 15,000 bricks.

Central Sand and Gravel Co., Pine Bluffs, Ark., $25,000. E. N. Jenkins, F. H. Neely and E. W. Higgins, all of Pine Bluffs. Will operate sand and gravel plant at Radway, Ark.

Duro Cement Block and Construction Corp., Brooklyn, N. Y., $15,000. A. Berman, 1722 52nd St., Brooklyn, S. Berman and G. Deresi. (Atty. M. H. Katz, 305 Broadway, N. Y.)

Brunswick Cement Products Co., South River, N. Y., $100,000. F. L. and Lucy Oswald of South River, L. L. Work, Jamaica, N. Y. (Atty. R. E. Watson, New Brunswick.)

Eureka Pressed Brick Corp., Ltd., Toronto, Canada, $600,000. L. S. Bursey, C. R. Crean, H. G. Williams of Toronto, and H. W. Alport of Detroit and others. Manufacture and deal in artificial stone, lime, cement blocks, cement, etc. Office established at 1501 Metropolitan Bldg., Toronto and plant at Rogers Road, Toronto.

Sand and Gravel

Pueblo Bridge and Construction Co., Pueblo, Colo., have leased the gravel rights of a part of the district owned by the city.

Minton Sand Co., Mountain View, Calif., are to make additions to their dry kilns; will erect sand and gravel bunkers, spur track and other equipment to cost about $40,000.

Galesburg Sand and Gravel Co., Galesburg, Ill., has had a busy season, having shipped 725 carloads of sand and gravel from their plant at Gravel Hill. It is expected that over 200 more carloads will be shipped before the close of the season.

Albany Sand and Supply Co., Albany, N. Y., of which Lawrence Murphy is president, has purchased 750 acres of land near Saratoga Springs, N. Y., for a consideration of $25,000. Two hundred acres of this land are said to consist of molding sand.

Vincennes Sand and Gravel Co., Vincennes, Ind., have replaced the steam driven pump on their gravel dredge with a 60 h.p. slip ring motor made by the General Electric Co. It is said by this replacement costs have been cut 10 cents a yard and production increased from 115 to 227 cu, yd. of gravel per 10 hr. day.

Limestone

T. F. Moffett, Stephens county, Texas, has leased a tract of limestone land near Littlefield, Texas. He will install two large crushers and is expected to be ready to start production within a short time.

Lime

American Lime and Stone Co., Bellefonte, Penn., is to expend $225,000 for enlargement and improvements to their hydrating plant.

Cummer Co., Jacksonville, Fla., are reported to erect a lime plant at Kendrick, Fla., Charles H. Lloyd to be in charge of construction.

Gypsum

Ontario Gypsum Co., Ltd., with warehouses at 106 Don Esplande, has moved offices from 811 Federal Bldg. to 906 Northern Ontario Bldg., at 330 Bay St., Toronto.

U. S. Gypsum Co., Chicago, Ill., will be represented in the East Bay district of California by Glenn A. Gibbs, formerly northern California representative of the Buttress Mfg. Co.

U. S. Gypsum Co., Chicago, Ill., is reported to have preliminary plans for the construction of a new plant on the East river at 35th St., New York, to cost about $200,000 with equipment. C. R. Birdsey is chief engineer.

Magnesite

California Magnesite Co., of San Francisco, Calif., is beginning the construction of 1000 ft. tunnel at its magnesite mine sixteen miles from Patterson, Calif. This will enable them to take out the product from below instead of hoisting as has been done in the past.

Cement

Signal Mountain Portland Cement Co., Chattanooga, Tenn., is about to begin improvements to its plant to cost about $300,000.

Acme Cement Corp. has let the contract for construction of a crusher building, storage bins, etc., at the plant at Catskill, N. Y., at a cost of $150,000.

Allen H. Stubbs, field engineer for the Portland Cement Association, will give a series of lectures on the preparation and use of cement at Kansas City, Kans.

Carolina Portland Cement Co., Charleston, S. C., is reported to establish a branch warehouse at Columbia, S. C. Lime, crushed stone and other building supplies will be carried in addition to cement.

Peerless Portland Cement Co., Detroit, Mich., are rumored to have plans for the establishment of a $1,000,000 plant at Augusta, Kans., with branch offices at Wichita. It is said a preliminary survey has been already completed near Augusta.

Arkansas Cement Corp. and White Cliffs Corp. of White Cliffs, Ark., are reported to have made plans for the reopening operation of limestone deposits and the erection of a cement plant in connection with their present plant which is used to manufacture whiting and asphalt filler.

Cement Products

Bartonville Rock Stone Co. of Bartonville, Ont., has established a branch factory on Weston Road, West Toronto.

N. V. Bastin, Hollywood, Fla., is reported to establish plant for the manufacture of cement tile, brick, blocks, etc.

Geo. J. Betzler & Son, Minneapolis, Minn., are erecting a concrete block building 42x61 ft. for their concrete block factory, at 2614 Marshall St.

Concrete Products Co., Cedar Rapids, Ia., of which F. M. Popenhagen is manager, is about to begin erection of 30x60 ft. addition to its plant.

Nel-Stone Co., of Texas, Gunter Bldg., San Antonio, Tex., of which A. Geridetti is manager, is increasing the capacity of its plant, and has ordered additional machinery.

Rex Concrete Products Co., Essex, Md., have acquired the plant formerly operated by Douglas Concrete Products Co. on Golden Ring Road and will operate it as a branch plant.

B. H. Morse, for the past five years manager of Willbee-Morse Concrete Co., Hillsdale, Mich., has become the sole owner of the business, which will be continued as Morse Concrete Products Co.

Quarries

Laubis Stone Co., Hepburn, Ohio, has been awarded three contracts to supply stone on road projects in Trumbull and Portage, counties, Ohio.

J. G. Kimmel, president of the Southern Construction Engineers, is reported to begin the operation of a limestone quarry near Sarasota, Fla., within a short time.

Diatomaceous Earth

M. J. Blair, North Troy, Vt. and associates, have acquired a fuller's earth plant with 248 acres adjoining, at Ellenton, Fla.

Personals

Carlton M. Soule, formerly chief engineer of the Spencer Construction Co. of Baltimore and Levigne M. Zepp, formerly assistant chief engineer, Richard K. Meade Co., announce their association for the practice of structural and mechanical engineering under the firm name of Soule and Zepp, Inc. Office will be maintained at 322 N. Charles St., Baltimore, Md., room 402.

Obituary

Henry L. Graf, president of the New Albany Wall Plaster Co., New Albany, Ind., died recently at his home at New Albany.

Daniel Goff, president of the Daniel Goff Co. of Millarville, N. J., which conducts a sand and gravel business at that city, died recently at his home. Mr. Goff has been in active business for 65 years, retiring but a few months before his death.

Manufacturers

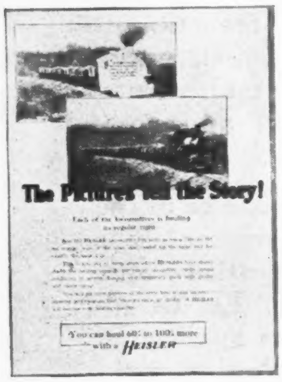
Foote Bros. Gear and Machinery Co., Chicago, Ill., announce the appointment of the following representatives: M. A. Hughes, Railway Exchange Bldg., Seattle, Wash., and Power Equipment Co., 315 Third Ave., Minneapolis, Minn.

Beckwith Machinery Co., Pittsburgh, Penn., with branch offices at Philadelphia, Cleveland and Charleston, W. Va., has taken over the distribution of equipment manufactured by the Clyde Iron Works, Duluth, Minn. They will act as exlusive distributors in the territory for the sale of hoisting machinery, derricks and accessories.

Sullivan Machinery Co., Chicago, Ill., has moved its Cleveland office in charge of R. T. Stone, from room 701, Rockefeller Bldg., to room 1506 in the same building. The Sydney, New South Wales, Australian office has been moved to Kemble Bldg., Margaret St., Sidney. R. D. Willets is the manager of this branch. Exhibits of Sullivan equipment at the All-Western Road Show at San Francisco will be under the direction of R. P. McGrath, manager of the San Francisco office.

Trade Literature

NOTICE — Any publications mentioned under this heading will be sent free unless otherwise noted, to readers, on request to the firm issuing the publication. When writing for any of these items kindly mention ROCK PRODUCTS.



Heisler Locomotive Works, Erie, Penn., have issued a new bulletin in which they describe and illustrate the wide variety of locomotives made by them. Features the work performed by them at quarries, sand and gravel plants, etc., under different conditions. Contains specifications and data of interest to possible users. 18 pp., 8½x11 in.

Marion Steam Shovel Co., Marion, Ohio, has prepared a new bulletin No. 316 on the new Marion Model 125 steam and electric, which is ready for distribution on request. The bulletin illustrates and describes a shovel which the manufacturers claim has increased working efficiency and marked improvements.

Proper Tamping Methods. Explosives service bulletin illustrating and describing best methods of preparing dummies for tamping bore holes. E. I. DU PONT DE NEMOURS & CO., Wilmington, Del.

Air Compressors, Pumps, Etc. General Products Bulletin No. 125 containing comprehensive views of air compressors, centrifugal and lift pumps, vacuum pumps, after coolers, etc. Illustrations, table of sizes and data. 16 pp. 8½x11 in. PENNSYLVANIA PUMP AND COMPRESSOR CO., Easton, Penn.

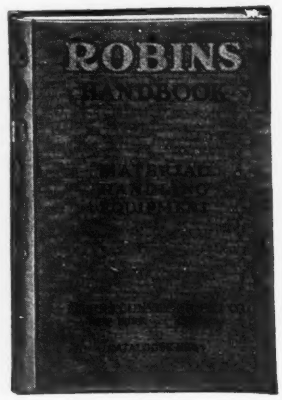
Burial Vault Forms. Bulletin illustrating welded steel forms for making concrete burial vaults. DOSWELL & KOVER, Fort Wayne, Ind.

Concrete Floor Hardeners. Bulletin describing Rockote, a specially prepared liquid said to prevent "dusting" and to provide hard, dust proof surface for concrete floors. GOHEEN CORP., Newark, N. J.

Plant Equipment. Bulletin illustrating complete plant equipment such as kilns, tanks, engines, dryers, barges, etc. 14 pp. 8½x11 in. MANITOWOC SHIPBUILDING CORP., Manitowoc, Wis.

Induction Motors. Bulletin No. 1132 illustrating and describing types **AR** and **ARY**, polyphase induction motors. Features mounting on cast steel frames and equipment with Timken tapered roller bearings. 4 pp. 8x11½ in. ALLIS-CHALMERS MFG. CO., Milwaukee, Wis.

Concrete Structures. Bulletin illustrating in sepia reproduction the most notable concrete structures of the year. PORTLAND CEMENT ASSOCIATION, Chicago, Ill.



Handbook for Handling Machinery. Handbook illustrating this type of machinery and actual installations in plants throughout the country. Contains interesting and valuable data on all phases of handling machinery. 270 pp. ROBINS CONVEYING BELT CO., Park Row Building, New York.

Crushing Rolls, Bulletin No. 1823, featuring "Garfield" type of crushing rolls. Illustrations and descriptions, details of construction, capacity, speed, etc., 30 pp. 8x10½ in.

Texrope Drive. Bulletin No. 1228, featuring and illustrating flexible and positive multiple belt drive for close centers to be used in driving crushing machinery, mining machinery, stokers, etc. Excellent data and graph for determination of length of drive required. Tables for computation of power, circumferential velocities and speeds, etc. ALLIS-CHALMERS MANUFACTURING CO., Milwaukee, Wis.

Explosive Service Bulletin. Excellent recommendations on safety methods to be followed in quarry blasting operations. E. I. DU PONT DE NEMOURS & CO., INC., Wilmington, Del.
ADD MFRS

Half Million Miles of Surfaced Roads

THE MILEAGE of surfaced roads in the United States is nearing the 500,000 mark according to the Bureau of Public Roads of the United States Department of Agriculture. Some weeks ago the state reports indicated that there were 128,347 miles of surfaced road on the state systems at the end of 1924 and similar subsequent reports from the states indicated that mileage of surfaced county roads was 339,558 making a total of 467,905 miles. While it is probable that the estimate of county roads is not so accurate as that of the state roads, the above figure is probably not too large.

Since 31,541 miles of road was surfaced in 1924 by the states and counties and it is known that progress has been equally as good in 1925, it is probable that the construction season now drawing to a close will increase the surfaced mileage to more than 495,000. In this estimate allowance was made for a portion of the year's work being resurfacing or higher improvement of roads previously reported as surfaced.